

USE OF EXISTING INFORMATION SYSTEMS AND DATA TO SUPPORT BRIDGE MANAGEMENT AT TXDOT

by

Cesar Quiroga, P.E.
Research Engineer
Texas Transportation Institute

Nicholas Koncz
Assistant Research Scientist
Texas Transportation Institute

Jerry Le
Software Applications Developer
Texas Transportation Institute

Yingfeng Li
Assistant Research Scientist
Texas Transportation Institute

and

Andrew Wimsatt, P.E.
Division Head
Texas Transportation Institute

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LIST OF ACRONYMS, ABBREVIATIONS, AND TERMS

AASHTO	American Association of State Highway and Transportation Officials
BAMS/DSS	Bid Analysis Management System/Decision Support System
BCI	Bridge Cost Information
BMIS	Bridge Management Information System
BPS	Bid Proposal System
BRINSAP	Bridge Inventory, Inspection, and Appraisal System
CFR	Code of Federal Regulations
CICS	Customer Information Control System
CIS	Contract Information System
CMCS	Construction/Maintenance Contract System
CPS	Central Permitting System
CSJ	Control Section Job
CTS	Contract Tracking System
DCIS	Design and Construction Information System
EMP	Equivalent-Match Project
EOS	Equipment Operations System
FHWA	Federal Highway Administration
FIPS	Federal Information Processing Standard
FIMS	Financial Information Management System
GIS	Geographic Information System
GUI	Graphical User Interface
HBP	Highway Bridge Program
HPTMS	Highway Project Task Management System
MEARS	Maintenance Efficiency and Analysis Reporting System
MMIS	Maintenance Management Information System
MMS	Maintenance Management System
MSMS	Material Supply Management System
MST	Main Street Texas
NBI	National Bridge Inventory
ODBC	Open Database Connectivity
OS/OW	Oversize/Overweight
P3	DCIS Project Evaluation Screen
P3B	DCIS Project Evaluation – Bridge Screen
PDMS	Project Development Management System
PMIS	Pavement Management Information System
PSN	Permanent Structure Number
PWP	Participation-Waived Project
RJEJCL	Remote Job Entry Job Control Language
SES	Single Entry Screen System
SLD	Salary and Labor Distribution System
STIP	State Transportation Improvement Program
TACS	Table Accounting Code System
TEBSS	Texas Eligible Bridge Selection System
TRM	Texas Reference Marker System

TSD	Technology Services Division
TSID	TxDOT's System Interface Diagram
TxDOT	Texas Department of Transportation
TxMAP	Texas Maintenance Assessment Program
TxPROS	Texas Permit Routing Optimization System
VB	Visual Basic
VSAM	Virtual Storage Access Method

CHAPTER 1. INTRODUCTION

One of the tasks of research project 0-6389 was to develop a prototype database application that could link available bridge-related data sources at the Texas Department of Transportation (TxDOT) to enable the production of queries and reports needed for a variety of analytical purposes. TxDOT was particularly interested in a prototype application that could support short-term needs ahead of the potential development and implementation of a full-fledged Bridge Management Information System (BMIS).

Feedback provided by Bridge Division officials indicated that the greatest data reporting needs for the standalone prototype database application involved (a) extraction of data for the production of summary bridge statistics needed for the annual bridge report and other similar queries and (b) extraction of data for the production of bridge cost estimates and related quality control checks. In practice, these two tracks resulted in two different prototype database applications, along with different sets of tables, queries, and customization processes.

The following chapters describe the process to develop and use the prototype database applications, as follows:

- Chapter 2 includes a review of existing bridge-related data sources at TxDOT.
- Chapter 3 describes the development of the prototype database application to extract summary bridge statistics needed for the annual bridge report and other similar queries.
- Chapter 4 describes the development of the prototype database application to extract data for the production of bridge cost estimates and related quality control checks.
- Chapter 5 includes an installation and user guide for the prototype database applications.

CHAPTER 2. REVIEW OF EXISTING DATA SOURCES

INTRODUCTION

Several information systems at TxDOT contain data that pertain to the design, construction, operation, and maintenance of bridges, including the following:

- Design and Construction Information System (DCIS),
- Maintenance Management Information System (MMIS),
- Bridge Inventory, Inspection, and Appraisal System (BRINSAP),
- PonTex,
- Pontis,
- Financial Information Management System (FIMS),
- Texas Permit Routing Optimization System (TxPROS),
- Permanent Structure Number (PSN) application, and
- Bridge Shop Plan.

The following sections provide a summary of these information systems.

DESIGN AND CONSTRUCTION INFORMATION SYSTEM

TxDOT uses DCIS to facilitate project planning, programming, and development at the department. This legacy system supports the project development process through storage and management of project identification and evaluation data, project planning and finance data, project estimate data, and contract summary data (1). Over the years, TxDOT has developed linkages between DCIS and other TxDOT systems, such as the Bid Analysis Management System/Decision Support System (BAMS/DSS), the Bid Proposal System (BPS), the Contract Tracking System (CTS), and FIMS.

DCIS runs on an Adabas non-relational database platform, which stores data in files of variable length array structures. Relationships between these files are primarily through a control section job (CSJ) number that uniquely identifies projects. DCIS files include the following (2):

- **File 121 (DCIS -PROJECT-INFORMATION).** This file contains basic data describing highway construction and maintenance projects during the planning and development phases (Table 1).
- **File 122 (DCIS-WORK-PROGRAM).** This file contains data on highway construction work programs and the state transportation improvement program (STIP) (Table 2).
- **File 123 (DCIS-PROJECT-ESTIMATE).** This file contains estimated cost data for individual projects, including bridges (Table 3).
- **File 124 (DCIS-CONTRACT-LETTING).** This file contains the last three months' letting data for highway construction and maintenance projects (Table 4).

- **File 108 (DCIS-FUNDING-INFORMATION).** This file contains project funding data (Table 5).
- **File 109 (DCIS-PROJECT-COST).** This file contains data that pertain to the total cost of a project (Table 6).
- **File 110 (DCIS-PROVIDER-INFORMATION).** This file contains data about project fund providers (Table 7).

DCIS includes a large number of screens that enable authorized users to complete data inputs and updates and run queries and reports. Of the various screens, the project evaluation–bridge screen (P3B) shows information on bridges that are included in transportation projects. This screen is accessible through the project evaluation screen (P3). The P3B screen allows users to view and update the following bridge and related data (1):

- Project CSJ number,
- District number,
- Off system route number,
- Bridge sufficiency rating,
- Bridge deficiency class,
- Program qualification code,
- Texas eligible bridge selection system (TEBSS) score,
- National bridge inventory (NBI) number,
- Historical significance code,
- Structure type code, and
- Critical deficiency indicator code.

Table 1. DCIS File 121 (DCIS-PROJECT-INFORMATION) Data Fields.

Field	Field	Field
COMMON-DATA	LANE-MILES	PROGRAM-QUALIFICATION-CODE
CONTROL-SECT-JOB	SHLDR-MILES	BRIDGE-DEFICIENCY-CLASS
DISTRICT-NUMBER	BRIDGE-DECK	CRITICALLY-DEF-INDICATOR
LAST-REVISION	NUMBER-BRIDGES	BRIDGE-WORK-TYPE
DATE-LAST-REV	PRES-ADT	BRIDGE-SUFFICIENCY-RATING
TIME-LAST-REV	PROJ-ADT-YEAR	KOW-BROAD-CODE
REQUIRED-ID-DATA	PROJ-ADT	SEG-ID
COUNTY-NUMBER	PERCENT-TRUCKS	MAINT-FUNCTION-CODE
HIGHWAY-NUMBER	KEQWL-18	PROJECT-INFO-METRIC-GROUP
PROJ-LENGTH	EXST-DSGN-SPD	ADDL-ROW-METRIC-MEAS
CATEGORY	PROP-DSGN-SPD	BRIDGE-DECK-METRIC-MEAS
ELIG-FED-FUND	EXST-CRNWDTH	PROP-BRIDGE-DECK-METRIC-MEAS
PROJ-CLASS	PROP-CRNWDTH	EXIST-LANE-WIDTH-METRIC-MEAS
MANAGER-NUMBER	CAP-GAP	EXIST-ROAD-WIDTH-METRIC-MEAS
EST-CONST-COST	GEOM-GAP	PROP-ROAD-WIDTH-METRIC-MEAS
DATE-EST-COST	PES1-LANES	EXIST-SHLDR-WIDTH-METRIC-MEAS
AUTO-LINE-NUMBER	PES1-SCORE	EXIST-CRNWDTH-METRIC-MEAS
TYPE-OF-WORK	PES2-LANES	PROP-CRNWDTH-METRIC-MEAS
LIMITS-FROM	PES2-SCORE	EXIST-DESGN-SPD-METRIC-MEAS
LIMITS-TO	OVRLAY	PROP-DESGN-SPD-METRIC-MEAS
LAYMAN-DESCRIPTION1	PVMT-QUAL	EXIST-LENGTH-METRIC-MEAS
LAYMAN-DESCRIPTION2	DSGN-LIFE	PROP-LENGTH-METRIC-MEAS
BEG-MILE-POINT	TERRAIN	KNESAL-80-METRIC-MEAS
END-MILE-POINT	CITY-CODE	LANE-LENGTH-METRIC-MEAS
OPTIONAL-ID-DATA	DIST-PRIOR	OVERLAY-METRIC-MEAS
CONTRACT-CSJ	ACC-YEAR1	PROJ-LENGTH-METRIC-MEAS
PROJ-SUSP	ACC-YEAR2	SHLDR-LENGTH-METRIC-MEAS
PRIORITY-CODE	ACC-TYPE	LOCAL-CONTRIBUTIONS-AMT
PDP-LET-DATE	ACC-FATAL	STATE-TRANS-IMPRV-PGM-GRP
DIST-LET-DATE	ACC-FATAL-TOTAL	STIP-PROJECT-ID
ORIGINAL-PLANNED-LET-DATE	ACC-INJ	STIP-PHASE-CODE
DIST-LET-CHANGES-NBR	ACC-INJ-TOTAL	STIP-REVISION-DATE
APPRVD-LET-DATE	ACC-TOTAL	STIP-IMPLEMENT-AGENCY-CMNT
ACTUAL-LET-DATE	ACC-TOTAL-TOTAL	STIP-REVISION-LOCK-FLAG
BACKLOG-PROJ	COMMENTS1	STIP-PROJECT-DESCRIPTION1
EST-ROW-COST	COMMENTS2	STIP-PROJECT-DESCRIPTION2
DATE-EST-ROW	COMMENTS4	STIP-PROJECT-DESCRIPTION3
RA-FLAG	PROP-BRIDGE-DECK	STATEWIDE-CSJ
OTHER-PART	ENGINEER-INFO	RESP-SECTION
PROJECT-NUMBER	ENGINEER-NO	NATIONAL-HIGHWAY-SYSTEM-FLAG
CONST-COMP	AUTHORIZATION-DATE	CONSULTANT-FLAG
PSE-COMP	HOUSE-DIST	DONATED-FLAG
ROW-COMP	SENATE-DIST	STATE-HOUSE-DISTRICTS
HIGHWAY-SYSTEM	NEW-HOUSE-DIST	STATE-SENATE-DISTRICTS
REMARKS	NEW-SENATE-DIST	FEDERAL-HOUSE-DISTRICTS
MISCELLANEOUS-FIELDS	LET-SCH-LOCK-FLAG	COMMENTS5
DIST-ENG-EST	LET-SCH-1	TAPERED-MATCH
D8-ENG-EST	LET-SCH-2	TOLL-CREDITS
MISC-COST	LET-SCH-3	PART-WAIVED-PROJECT
PROJ-BID-AMOUNT	SPEC-BOOK-YR	ECON-DIS-CO-PROJECT
TOT-OBG-AMOUNT	PROJECT-DEV-PLAN-GRP	STATE-LOA
EC-PERCENT	ROAD-LOCN-CODE	POPULATION-AREA
ITEM-500-AMOUNT	PDP-PROJECT-CODE	DESIGN-STANDARD
ANCESTOR-CSJ5	EXIST-IC-CODE	PE-FEDERAL-LOA
DESCENDENT-CSJ5	PROPOSED-IC-CODE	PE-APPN-CODE

Table 1. DCIS File 121 (DCIS-PROJECT-INFORMATION) Data Fields (Continued).

Field	Field	Field
WORK-PGM-ARRAY10	ADT-IC-CROSSROAD-NBR	PE-FEDERAL-DOLLARS
WORK-PROGRAM	IC-CROSSROAD-LANES-NBR	RG-FILLER
PROJ-COST	CROSSROAD-TYPE-CODE	PE-DISTRICT
PROJ-ID-SIGN	EXIST-LANE-WIDTH-MEAS	MAX-FED-FUNDS
ROW-AMOUNT	EXIST-SHLD-WIDTH-MEAS	TO-DISTANCE-FROM-ORIGIN
ROW-ID-SIGN	SIGNALS-PRESENT-FLAG	FROM-DISTANCE-FROM-ORIGIN
FIXED-FLAG	ADT-CRITICAL-CROSSROAD-NBR	ANNUAL-COST-GRP
CATEGORY-P2	SIG-CROSSROAD-LANES-NBR	ANNUAL-UTP-YEAR
PID	CIRCUM-RADIAL-CODE	ANNUAL-CONST-EST
APPORTIONMENT-CODE	COST-EFFECT-INDEX-NBR	ANNUAL-ROW-EST
MATCH-TYPE	PROJECT-RANK-NBR	ANNUAL-COST-DATE-RUN
MATCH-SOURCE	TRUNK-SYS-FLAG	BRIDGE-REMARKS1
APPLIED-PERCENT	REFERENCE-MARKER-GRP	BRIDGE-REMARKS2
FUNC-CODE-FROM	BEG-REF-MARKER-NBR	MATCH-AMOUNT-TOTAL
FUNC-CODE-TO	BEG-REF-MARKER-DISP	TOTAL-COST-DOLLAR-PE
MINUTE-ORDER-NUMBER	END-REF-MARKER-NBR	BOND-INTEREST-PAY-AMT
MINUTE-ORDER-DATE	END-REF-MARKER-DISP	INTEREST-TYPE-CODE
STATE-COST-PCT	ADHOC-REPORT-GRP	CMCS-LET-FLAG
LOCAL-COST-PCT	ADHOC-REPORT-ID	TRM-UPDATE-FLAG
EVAL-DATA	MPO-CODE	PRESERVATION-PERCENT
RDWY-FUNCT-CLS	TIP-FY	MOBILITY-PERCENT
URBAN-RURAL	COMMENTS3	ROW-CSJ
CONTROL-SECT-ACTUAL	BRIDGE-DATA-GRP	MEGA-PROJECT-ID
PVMT-TYPE	HISTORICAL-BRIDGE-FLAG	SUPER-ZA
EXST-MNLN-NUM	BRIDGE-LAST-UPDATED-DATE	SUPER-ZB
EXST-MNLN-TYPE	LINE-NUMBER-CARD12	SUPER-ZC
EXST-FTG-NUM	EXIST-ROAD-WIDTH-MEAS	SUPER-ZD
EXST-FTG-TYPE	PROP-ROAD-WIDTH-MEAS	SUPER-ZE
EXST-LENGTH	STRUCTURE-DATA-GRP	SUPER-ZF
PROP-MNLN-NUM	STRUCTURE-NBR	SUPER-ZG
PROP-MNLN-TYPE	ON-STATE-ID	SUPER-ZH
PROP-FTG-NUM	OFF-STATE-ID	SUPER-ZI
PROP-FTG-TYPE	NBI-NBR	SUPER-ZM
PROP-LENGTH	STRUCTURE-TYPE	SUPER-ZN
EVAC-RTE	HISTORICAL-SIGNIFICANCE	SUPER-ZO
ADDL-ROW	TEBSS-SCORE-PCT	

Table 2. DCIS File 122 (DCIS-WORK-PROGRAM) Data Fields.

Field	Field	Field
WORK-PROGRAM	STIP-PROJECT-ID	STIP-LAYMANS-DESC
CONTROL-SECT-JOB	STIP-PROJECT-NBR	STIP-PROJECT-CMNT
DISTRICT-NUMBER	STIP-PHASE-CODE	STIP-REVISION-DATE
DATE-LAST-REV	STIP-FEDERAL-COST-PCT	STIP-LOCK-FLAG
TIME-LAST-REV	STIP-STATE-COST-PCT	STIP-IMPLEMENT-AGENCY-CMNT
TOTAL-DATA	STIP-LOCAL-CONTRIBUTIONS-AMT	STIP-PROGRAM-COST
FIS-YEAR	STIP-LOCAL-COST-PCT	STIP-APPORTIONMENT-CODE
YEARS-ACTIVE	STIP-EST-CONSTRUCTION-AMT	STIP-FEDERAL-COST-TOTAL
TOTAL-OBLIG-AMT	STIP-FUNCTIONAL-CLASS-CODE	STIP-STATE-COST-TOTAL
TOTAL-ALLOC-AMT	STIP-STATE-CATEGORY-CODE	STIP-LOCAL-COST-TOTAL
DISTRICT-ARRAY25	STIP-DISTRICT-EST-LET-DATE	STIP-PROJ-LENGTH-METRIC
DIST-ALLOC-AMT	STIP-EXISTING-LANE-AMT	STIP-FHWA-APPROVAL-DATE
DIST-OBLIG-AMT	STIP-PROPOSED-LANE-AMT	MINUTE-ORDER-GRP
CZ-FILLER-FIELD	STIP-PROJECT-LENGTH-MEAS	MINUTE-ORDER-NBR
STATE-TRANS-IMPRV-PGM-GRP	STIP-LOCATION-FROM-DESC	MINUTE-ORDER-DATE
STIP-MPO-CODE	STIP-LOCATION-TO-DESC	MINUTE-ORDER-REMARKS
STIP-FY		

Table 3. DCIS File 123 (DCIS-PROJECT-ESTIMATE) Data Fields.

Field	Field	Field
COMMON-DATA	ENG-ESTIMATE-PRICE	NEW-NBI-NUMBER
CONTROL-SECT-JOB	UNIT-PRICE	BRIDGE-WORK-TYPE
LAST-REVISION	BIDITEM-FLAG	OLD-BRIDGE-TYPE
USER-LAST-REV	BIDITEM-DESCRIPTION	NEW-BRIDGE-TYPE
DATE-LAST-REV	UNIT-WORK	ROADWAY-CLEAR-WIDTH
TIME-LAST-REV	COMMENT	BRIDGE-NAME
PLANS-ESTIMATE-DATA	CATGWORK-DESC	BRIDGE-SYSTEM-ID
LINE-NUMBER	CATGWORK-MILES	BRDG-COST-GRP
CARD-TYPE	FUND-SOURCE-GROUP3	BRDG-LENGTH
ALTERNATE-GROUP-NO	FUND-SOURCE	BRDG-NBI-NUMBER
BIDITEM-SPECPROV	PERCENT-PART	BRDG-TYPE
BIDITEM-NO	BRIDGE-COST-DATA	BRDG-SYSTEM-ID
BIDITEM-DESC-CODE	BRIDGE-LENGTH-EXISTING	BRDG-DECK-AREA
SPECIAL-PROV-NO	BRIDGE-LENGTH-PROPOSED	BRDG-COST-PERCENT
BIDITEM-REF-NO	BRIDGE-WIDTH-EXISTING	SUPER-ZA
SPCL-000-PROV-TEXT	BRIDGE-WIDTH-PROPOSED	SUPER-ZC
SPECIAL-ACCT-NO	BRIDGE-REMOVAL-BREAKBACK	SUPER-ZD
ENG-QUANTITY	OLD-NBI-NUMBER	SUPER-ZE

Table 4. DCIS File 124 (DCIS-CONTRACT-LETTING) Data Fields.

Field	Field	Field
COMMON-DATA	ENG-PHONE	NOTICE-DESC
CONTRACT-CSJ	MBE-WBE-FLAG	NOTICE-STATUS-CODE
LAST-REVISION	PROPOSAL-GUARANTY-AMT	D48-ROSCP-PDS-NAMES-GRP
DATE-LAST-REV	WAIVER-FLAG	PDS-GNRL-NOTES-NAME
TIME-LAST-REV	DIVISION-RESPONSIBLE	PDS-REVISION-NOTE-NAME
RECORD-TYPE	INCLUDED-PROJECTS191	PDS-SPEC-LIST-NAME
BIDITEM-SUMMARY-DATA	COMBINED-FLAG191	BID-TAB-DOTS-STATUS-CODE
BIDITEM-SEQUENCE-NO	TOTAL-MISC	CNTRCT-EST-LET-DAY
ALTERNATE-GROUP-NO	TYPE-OF-WORK	AD-GRP
BIDITEM-NO	LIMITS	AD-STATUS-CODE
BIDITEM-DESC-CODE	EST-CODE	USER-NAME
SPECIAL-PROV-NO	RESP-DIST	USER-DATE
SPECIAL-ACCT-NO	LOCAL-LET	USER-TIME
QUANTITY	INCENTIVE-FIELDS	INITIAL-AD-DATE
ESTIMATED-PRICE	USER-COST-AMT	CONTRACT-COUNTIES
DUP-PRICE-INDICATOR	RU-BID-DAYS	CONTRACT-LOCK-DATA
BIDDER-CONTROL-DATA	USER-COST-INCOMP-FLAG	LOCK-CICS-OPERATOR-ID
BIDDER-SEQNO	USER-COST-TOTAL	LOCK-UPDATE-DATE
TOTAL-BID	INC-DIS-WORK-DAYS	LOCK-UPDATE-TIME
VERIFY-CODE	CONTRACT-OJT-GOAL	LOCK-ACTION-CODE
BIDDER-RANKNO	CONTRACT-DBE-GOAL-PCT	LOCK-FLAG
INCOMPLETE-FLAG	WORK-CAL-FLAG	WAGE-RATE-ID
VENDOR-NOS	PROP-REVISION-DATES10	BLDG-CONTRACT-CSJ-GRP
BI-SEQNO-DISCREP31	PLAN-SHEET-REVISION-DATES10	BLDG-CONTRACT-CSJ-4
BIDITEM-ALT-FLAG9	D48-PROJECT-STATUS-FLAG	BLDG-CONTRACT-CSJ-5
BIDITEM-ALT-FLAG	GRAPHICS-FLAG	BLDG-CONTRACT-CSJ-7
BIDITEM-DETAIL-11	REVISION-NOTE-LOC	BLDG-CONTRACT-CSJ-9
UNIT-PRICE	REVIEW-ENGINEER-ARRAY	AUS-HQ-MAINT-FLAG
BID-AMOUNT	REVIEW-ENGINEER-NO	AUS-HQ-BLDG-FLAG
ALTERNATE-GROUP	REVIEW-AUTHORIZATION-DATE	TOTAL-CONTRACT-COST
BI-INCOMPLETE-FLAG	LATEST-PROP-RELEASE-DATE	CMCS-LET-FLAG
CONTRACT-SUMMARY	CONTRACT-REMARKS	TOTAL-BID15
CONTRACT-NUMBER	PRE-BIDDERS-MEETING-GRP	SUPER-ZA
WORKING-DAYS	PRE-BIDDERS-MEETING-DATE	SUPER-ZB
LETTING-STATUS-CODE	PRE-BIDDERS-MEETING-TIME	SUPER-ZC
RECEIVED-UNTIL-TIME	PRE-BIDDERS-MANDATORY-FLAG	SUPER-ZD
RECEIVED-UNTIL-DATE	PRE-BIDDERS-MEETING-SP-CODE	SUPER-ZE
ENGINEER-INFO	PRE-BIDDERS-SPECIAL-TEXT-FLAG	SUPER-ZF
ENG-NO	CNTRCT-EST-LET-GRP	SUPER-ZG
ENG-NAME	CNTRCT-EST-LET-DATE	SUPER-ZH
ENG-ADDRESS	CNTRCT-EST-LET-TIME	SUPER-ZI
ENG-CITY	NOTICE-TO-CNTRCTR-GRP	SUPER-ZM
ENG-ZIPCODE	INITIAL-NOTICE-DATE	SUPER-ZN

Table 5. DCIS File 108 (DCIS-FUNDING-INFORMATION) Data Fields.

Field	Field	Field
CONTROL-SECT-JOB	ROW-AMOUNT	MINUTE-ORDER-DATE
FUND-TYPE-CD	FIXED-FLAG	FEDERAL-COST-PCT
COST-LINE-NBR	CATEGORY-P2	STATE-COST-PCT
COST-FEDERAL-AMT	PID	LOCAL-COST-PCT
COST-STATE-AMT	APPORTIONMENT-CODE	CHANGE-ORDER-DATE
COST-LOCAL-AMT	APPLIED-PERCENT	DISTRICT-NUMBER
COST-LOCAL-CNTRB-AMT	FUNC-CODE-FROM	SUPER-ZA
WORK-PROGRAM	FUNC-CODE-TO	SUPER-ZB
PROJ-COST	MINUTE-ORDER-NUMBER	

Table 6. DCIS File 109 (DCIS-PROJECT-COST) Data Fields.

Field	Field	Field
CONTROL-SECT-JOB	TOTL-BOND-AUTH-AMT	TOTAL-LOCAL-CONTR-AMT
CORRIDOR-NBR	TOTL-BOND-COST-LETING-AMT	TOTAL-OTHER-PART
RECORD-TYPE	TOTL-CE-AUTH-AMT	ROW-EST-JOINT-BID
EST-PE-PCT	TOTL-CE-COST-LETING-AMT	EST-ROW-COST15
EST-CE-PCT	TOTL-CNTGCY-AUTH-AMT	ROW-FEDERAL-DOLLARS
EST-CNTGCY-PCT	TOTL-CNGTCY-COST-LETING-AMT	ROW-DATE-LAST-REV
EST-INDIRECT-PCT	TOTL-INDRCT-AUTH-AMT	TOT-OBG-AMOUNT15
TOTAL-COST-AMT	TOTL-INDRCT-COST-LETING-AMT	DIST-ENG-EST15
PE-CURR-EST-PCT	INFLATION-PERCENT	PROJ-BID-AMOUNT15
PE-CDA-STIPEND-AMT	ENGINEERING-PERCENT	CDA-NBR
PE-LN1-COMMENT	CONTINGENCIES-PERCENT	PROJ-BEG-LAT
PE-LN2-COMMENT	INDIRECT-PERCENT	PROJ-END-LAT
PE-LN3-COMMENT	TOLL-FLAG	PROJ-BEG-LON
PE-TAPERED-MATCH-FLAG	CDA-CODE	PROJ-END-LON
PE-TOLL-CREDITS-AMT	PTF-FLAG	ROW-FEDERAL-LOA
ROW-PROGRAM-CHARGE-AMT	RMA-FLAG	ROW-APPN-CODE
ROW-TAPERED-MATCH-FLAG	TOTAL-FEDERAL-AMOUNT	AFA-DATE
ROW-TOLL-CREDITS-AMT	TOTAL-STATE-AMOUNT	HIST-UTP-YEAR
TOTL-PE-AUTH-AMT	TOTAL-LOCAL-AMOUNT	HIST-CONST-EST
TOTL-PE-COST-LETING-AMT	TOTAL-AUTH-AMOUNT	HIST-ROW-EST
TOTL-CST-AUTH-AMT	EST-CONST-COST15	HIST-COST-DATE
TOTL-CST-COST-LETING-AMT	AUTH-INFLATION-PERCENT	HIST-EST-TYPE
TOTL-ROW-AUTH-AMT	LUMP-SUM-ROW	HIST-EST-ACID
TOTL-ROW-COST-LETING-AMT	LUMP-SUM-PE	

Table 7. DCIS File 110 (DCIS-PROVIDER-INFORMATION) Data Fields.

Field	Field	Field
CONTROL-SECT-JOB	FUNDING-DETAIL-TYPE	ISSUANCE-COST
RECORD-TYPE	FUNDING-DETAIL-CODE	CAPITALIZED-INTEREST
COST-LINE-NBR	FUNDING-DETAIL-PROVIDER	BOND-FINANCE-COST
FUNDING-DETAIL-AMT	BOND-INTEREST	SUPER-ZA

Common methods to access DCIS data at TxDOT include the following:

- **Direct access (1).** With this method, users log into ROSCOE and type RJEJCL (Remote Job Entry Job Control Language) to access a menu screen of TxDOT legacy information systems, such as DCIS, FIMS, and Pavement Management Information System (PMIS). In ROSCOE, data entry, query, processing, and report generation are completed using keyboard commands. DCIS has a set of predefined Natural reporting language-based report templates. The direct access mode is the most commonly used mode to access DCIS.
- **RJEJCL script (1).** With this method, users run customized RJEJCL scripts containing Natural report templates within the DCIS environment to produce custom reports. DCIS saves custom reports as text files that can be used later in reports, spreadsheets, or desktop databases.

- **SAS script.** With this method, users run PC SAS scripts using a SAS host connected to DCIS to retrieve data. The script saves the results in a file that can be used later in reports, spreadsheets, or desktop databases.

As mentioned previously, the DCIS Adabas environment is not compatible with relational database structures, particularly in relation to repeating groups. A repeating group is composed of attributes of the same type with values stored in an array. An example of a repeating group in DCIS is the list of ancestor and descendent CSJ numbers in File 121. Instead of using a separate file to handle ancestor and descendent CSJ numbers (with one record per ancestor or descendent CSJ number), historically, TxDOT has stored these CSJ numbers in single attribute arrays in File 121. A difficulty with this approach is how to track all the CSJ numbers associated with any CSJ in the database effectively. Another difficulty of using repeating groups is that the maximum size of an attribute array may be fixed, making it necessary to remove an attribute, e.g., the oldest one, to provide storage space for the latest value if there are more attribute values than the size of the array.

In recent years, TxDOT has begun to use an Adabas replicator utility to export Adabas data files to a Microsoft® SQL Server® environment. TxDOT has replicated all DCIS files into a SQL Server COMMON_DSGN schema. This process has involved converting non-relational Adabas data into a relational database structure. Although the resulting database does not fully comply with relational database industry standards, it is a huge improvement. Using replicated data in a relational database environment offers numerous benefits, including the following:

- compatibility with industry-standard database applications and streamlined data access protocols,
- lower costs associated with retrieving, managing, and maintaining data,
- lower demand on Technology Services Division (TSD) to develop customized Adabas scripts because users can have direct access to DCIS tables,
- use of relational database structures that facilitates the development of queries and reports, and
- near real time access to replicated DCIS data.

In the current implementation mode, every time there is a transaction that adds a new record or updates an existing record in DCIS, the replicator mimics that transaction in SQL Server, making the replicated tables near real time. Normally, users are provided read-only access to table views (i.e., indexed queries) of replicated tables. A number of options exist for accessing the data, including open database connectivity (ODBC) and SQL Server Management Studio.

Districts have started to develop applications using replicated tables. For example, Corpus Christi District officials replaced their Highway Project Task Management System (HPTMS), which used SAS scripts, with the Project Development Management System (PDMS), which relies on Adabas replicated tables.

MAINTENANCE MANAGEMENT INFORMATION SYSTEM

MMIS is a legacy data system the TxDOT Maintenance Division implemented in the late 1980s for managing highway maintenance data. MMIS contains data on 76 (of 116) routine maintenance functions, which together account for the majority of maintenance expenditures (3). The Daily Activity Report Form 1757 and the Weekly Activity Report Form 1784 record maintenance activity data. Currently, MMIS does not track maintenance activities pertaining to damage claims or maintenance facilities (4). Types of maintenance activities tracked in MMIS include the following:

- approaches and miscellaneous shoulder maintenance,
- asphaltic surfaces,
- base and subgrade,
- bridge and bridge channels,
- concrete pavement,
- extraordinary maintenance,
- roadside and other, and
- traffic operations.

Table 8 lists 14 function codes for bridge and bridge channel maintenance activities tracked by MMIS (4). Originally, MMIS had four function codes for bridge maintenance activities. Over time, TxDOT combined two function codes (i.e., Bridges, Rail [628] and Bridges, Rail Painting [633]), and added 11 MMIS function codes.

MMIS uses reference markers to identify the location of a maintenance activity. If a maintenance activity involves a bridge, it is possible to add a NBI number to the MMIS database. MMIS links to other TxDOT systems such as the Salary and Labor Distribution System (SLD), the Material Supply Management System (MSMS), and the Equipment Operations System (EOS). FIMS Segment 78 file stores MMIS cost data.

Like DCIS, MMIS runs on an Adabas platform and stores maintenance activity data in separate files. MMIS uses a combination of attributes (i.e., HWY_INFO, REFERENCE_MARKER, and FUNCTION_CODE) to identify relationships between separate files. MMIS files include the following (5):

- **File 96 (MMIS-AUDIT-FILE).** This file stores changes, such as additions, deletions, and revisions, to the MMIS-MASTER-FILE (Table 9).
- **File 98 (MMIS-TRANSACTION-FILE).** This file stores reference marker data along with contract and non-contract maintenance work. This file is updated daily and contains a record of amount of work performed and costs for each highway location (Table 10).
- **File 99 (MMIS-MASTER-FILE).** This file stores maintenance activity data for a specific highway location. This file is updated at the end of the month upon completion of the FIMS end-of-month process (3) (Table 11).

Table 8. MMIS Bridge and Bridge Channel Function Codes (4).

Function Code	Unit	Function	Description
610	-	Bridge, Movable Span	Operation, routine maintenance, and inspection of movable span bridges (swing barge, lift, or turn). Restricted use: Beaumont, Houston, Pharr, and Yoakum Districts only.
611	EA	Bridge, Portable	Installation, removal, maintenance, and inspection of portable bridges.
620	CY	Bridge Channel Maintenance	Removal of silt and drift, filling eroded areas, channel maintenance (including easements), and maintenance and repair of jetties and dikes.
628*	LF	Bridge Rail	Maintenance of bridge rail, posts, and post connections to deck, including painting.
645*	LF	Bridge Joint Maintenance	Repair of bridge joints, including cleaning and sealing.
646	LF	Bridge Joint Replacement	Replacement of bridge joints.
650*	SF	Bridge Deck	Repair to bridge decks.
660	SF	Bridge Superstructure, Concrete	Routine maintenance of the concrete components of the bridge superstructure, including bearings, concrete diaphragms, and beams.
665	SF	Bridge Superstructure, Steel	Routine maintenance of the steel components of the bridge superstructure, including steel diaphragms and beams.
670	SF	Bridge Substructure, Concrete	Routine maintenance of the concrete components of the bridge substructure, including caps, columns, abutments, wingwalls, pilings, etc.
675	SF	Bridge Substructure, Steel and Timber	Routine maintenance of the steel or timber components of the bridge substructure, including caps, abutments, pile extensions, etc.
680	SF	Bridge Painting	Cleaning and painting of superstructure or substructure.
690	-	Bridge, Mechanical and Electrical	Maintenance and repair of the electrical and mechanical components of a bridge.
695	EA	Fender Systems	Installation and maintenance of fender systems.

CY = Cubic Yard; SF = Square Foot; LF = Linear Foot; EA = Each; * = Original Function Code

Table 9. MMIS File 96 (MMIS-AUDIT-FILE) Data Fields.

Field	Field	Field
USER-INFO	COUNTY	AREA-INFO
USER-ID	HWY-INFO	OLD-AREA
SYSTEM-DATE-DT	HWY-LIMIT-INFO	NEW-AREA
SYSTEM-TIME	OLD-BEG-REF-MARKER	FUNC-CODE-INFO
FILE-CHANGE	OLD-END-REF-MARKER	OLD-FUNC-CODE
LOCATION-INFO	NEW-BEG-REF-MARKER	NEW-FUNC-CODE
YR-DIST-MAINTSECT-ID	NEW-END-REF-MARKER	TASK-NUMBER

Table 10. MMIS File 98 (MMIS-TRANSACTION-FILE) Data Fields.

Field	Field	Field
KEYS	COUNTY	MATERIAL-QUANTITY
ACCOUNT-NUMBER	HWY-INFO	CONTRACTOR-AMOUNT
DISTRICT	BEG-REF-MARKER	MISC-AMOUNT
MAINT-SECT	END-REF-MARKER	SES-DOCUMENT-NUMBER
TASK-NUMBER	AREA-UNIT	NBI-NBR
TRANS-DATE-DT	AREA	SUPERZA
TRANS-INFO	TASK-NUMBER-AMOUNTS	SUPERZB
DATE-WORK-PERFORMED-DT	LABOR-AMOUNT	SUPERZC
CONTRACT-NUMBER	LABOR-MANHOURS	SUPERZD
TYPE-OF-WORK	EQUIPMENT-AMOUNT	SUPERZE
FUNCTION-CODE	MATERIAL-AMOUNT	

Table 11. MMIS File 99 (MMIS-MASTER-FILE) Data Fields.

Field	Field	Field
KEYS	AREA-UNIT	MTD-COUNTRACTOR-AMOUNT
YR-DIST-MAINTSECT-ID	CONTRACT-NUMBER	MTD-PREPARATION-AMOUNT
COUNTY	TYPE-OF-WORK	MESSAGE
HWY-INFO	MMDD-STORE-DT	NBI-NBR
DEL-HWY-INFO-FLAG	MTD-AMOUNT	SUPERZA
REFERENCE-MARKER-INFO	MTD-LABOR-AMOUNT	SUPERZB
REFERENCE-MARKER	MTD-LABOR-MANHOURS	SUPERZC
BEG-REF-MARKER	MTD-EQUIPMENT-AMOUNT	SUPERZD
END-REF-MARKER	MTD-MATERIAL-AMOUNT	SUPERZE
FUNCTION-INFO	GF-FILLER	SUPERZF
FUNCTION-CODE	MTD-MATERIAL-AREA	
MMDD-UPDATE-DT	MTD-MISC-AMOUNT	

MMIS has two report generation options: Maintenance Efficiency and Analysis Reporting System (MEARS) report generation and MMIS report generation (3). The MEARS report compares in-house maintenance costs with the cost of maintenance performed under contract. MMIS report generation includes reports in the following categories:

- cost summaries, by highway type and function,
- production rates, by function, function rates by highway, and function rate comparison,
- rankings, by highway cost, function code cost, and highway type cost, and
- miscellaneous reports, such as daily transaction report, crew report, roadway inventory, job cost summary, expenditures by function code, function cost by reference marker, and maintenance section unit cost comparison.

Methods to access MMIS data include the following (3):

- Sign on to Customer Information Control System (CICS) and access the “Natural V2” Teleprocessing Applications Menu, which includes MMIS.
- Enter maintenance activity data through the Single Entry Screen System (SES). SES sends the appropriate data to four systems (i.e., MMIS, SLD, EOS, and MSMS).

- Sign on to ROSCOE to access the MMIS Report Print and View Menu, which allows users to view or print portions of MMIS reports.

TxDOT is implementing a new system, called the Maintenance Management System (MMS) to replace MMIS (6). MMS will support performance measures, high-level analyses of maintenance funding, needs identification at a general level (e.g., increase ride quality), and alternative analyses (“what if”). MMS will run on a relational database platform. The anticipated rollout date is mid 2011. The vendor (i.e., AgileAssets, Inc.) produced a draft application data plan for interfacing MMS with 17 TxDOT systems (7). These systems included Pontis, DCIS, Texas Maintenance Assessment Program (TxMAP), PMIS, FIMS, Construction/Maintenance Contract System (CMCS), and Texas Reference Marker System (TRM). MMS will store maintenance location by reference marker and displacement. If a maintenance activity involves a bridge, MMS can retrieve bridge data (e.g., NBI) from a Pontis interface.

The life cycle of a bridge can involve several of the following stages: replacement, removal/new location, widening, maintenance/repair, and rehabilitation. In DCIS, these stages are classified into work types. Generally DCIS stores data for project based bridge maintenance/repair; however, DCIS does not record routine bridge maintenance/repair activities. Currently routine bridge maintenance and repair activities and associated data are recorded in MMIS; in the future, these data will be recorded in MMS.

Bridge maintenance activities and associated data are a critical component in determining the life cycle stage of a bridge and for system-wide bridge management. These data are crucial in determining the anticipated life of bridge elements, in providing an initial assessment of critical bridges and as an aid in identifying potential treatments and future work. Locations with excessive bridge maintenance costs can be identified and examined. These locations can be compared with other locations with similar bridge elements to identify trends, as well as low performing or positive treatments. Replacement of low performing treatments can be prioritized based on impact and cost.

BRIDGE INVENTORY, INSPECTION, AND APPRAISAL SYSTEM

Title 23, Part 650 of the Code of Federal Regulations (CFR) requires states to prepare and maintain an inventory of all bridge structures (8). Federal Highway Administration’s (FHWA’s) *Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation’s Bridges* specifies data items and their coding for this inventory (9). FHWA collects data from the states to develop the NBI database.

BRINSAP stores and maintains inspection data for on- and off-system bridges and tunnels on Texas public roadways (10) and contains the data items required for the national bridge structure inventory. BRINSAP includes roadway structure characteristics, traffic data, inspection data, and ratings. Table 12 lists data fields stored in BRINSAP. On an annual basis, TxDOT converts BRINSAP bridge inventory files for off- and on-system bridges to the actual NBI format and submits this file to FHWA.

BRINSAP runs on a Virtual Storage Access Method (VSAM) data management system (11). TxDOT maintains separate BRINSAP files for on- and off-system structures. BRINSAP documentation includes format and coding guides, but not a data dictionary.

BRINSAP uses 13 data templates, called “card types” to update, delete, or add BRINSAP records (10). Table 12 shows the card type number for each BRINSAP data item. Card type 13 is not included in the coding guide. Consultant and district users run programs to update records (Program 120213), calculate sufficiency ratings (Program 120404), and edit bridge inspection files (Program 120409) (12).

Table 12. BRINSAP Data Fields (10).

Item No.	Item Name	Card Type	Number of Digits
Item 2	State Highway Department District	Card 01	2 Digits
Item 3	County Code	Card 01	3 Digits
Item 4	City, Town, or Place Code (Census Place Code)	Card 01	5 Digits
Item 5	Inventory Route	Card 01	10 Digit
Item 5.1	Structure Function	Card 01	1 Digit
Item 5.1A	Intersecting Route Structure Function	Card 10	1 Digit
Item 5.2	Principal Inventory Route	Card 01	2 Digit
Item 5.2A	Intersecting Route System	Card 10	2 Digits
Item 5.3	Designated Level of Service	Card 01	1 Digit
Item 5.4	Route Number	Card 01	4 Digit
Item 5.4A	Intersecting Route Highway Number	Card 10	4 Digit
Item 5.5	Directional Suffix	Card 01	1 Digit
Item 5.5A	Intersecting Route Direction	Card 10	1 Digit
Item 5.6	Business Route Suffix	Card 01	1 Digit
Item 5.6A	Intersecting Business Route Suffix	Card 10	1 Digit
Item 6	Features Intersected	Card 01	25 Digit
Item 7	Facility Carried By Structure	Card 02	18 Digit
Item 8	Structure Number	Card 01	10 Digit
Item 8.3	Duplicate Route Over	Card 01	1 Digit
Item 8.3A	Intersecting Duplicate Route Over	Card 10	1 Digit
Item 8.4	Control	Card 01	(Off System) 6 Digits; (On System) 4 Digits
Item 8.4A	Intersecting Route Control	Card 10	(Off System) 6 Digits; (On System) 4 Digits
Item 8.5	Section	Card 01	2 Digit
Item 8.5A	Intersecting Route Section Number	Card 10	2 Digit
Item 8.6	Permanent Bridge Number	Card 01	3 Digit
Item 8.6A	Intersecting Route Bridge Number	Card 10	3 Digit
Item 9	Location	Card 02	25 Digit
Item 10	Inventory Route, Minimum Vertical Clearance (XX feet XX inches)	Card 02	4 Digit
Item 10A	Intersecting Route Vertical Clearance (XX feet XX inches)	Card 11	4 Digit
Item 11	Inventory Route Milepoint (XX.XXX Miles)	Card 02	5 Digit
Item 11A	Intersecting Route Milepoint (XX.XXX)	Card 10	5 Digit
Item 11.1	Inventory Route Milepoint Date	Card 01	4 Digit
Item 11.1A	Intersecting Route Milepoint Date	Card 01	4 Digit
Item 11.1B	Inventory Route Reference Marker and Displacement	Card 01	11 Digit
Item 11.2B	Intersecting Route Reference Marker and Displacement	Card 10	11 Digit
Item 12	Base Highway Network	Card 13	1 Digit
Item 16	Latitude (XX Degrees XX.X Minutes)	Card 03	5 Digit
Item 17	Longitude (XXX degrees XX.X minutes)	Card 03	6 Digit
Item 19	Bypass, Detour Length (XX Miles)	Card 03	2 Digit
Item 19A	Intersecting Route Bypass Detour Length (XX Miles)	Card 11	2 Digit
Item 20	Toll	Card 03	1 Digit

Table 12. BRINSAP Data Fields (Continued).

Item No.	Item Name	Card Type	Number of Digits
Item 20A	Intersecting Route Toll Code	Card 11	1 Digit
Item 21	Maintenance Responsibility	Card 03	2 Digit
Item 22	Owner	Card 03	2 Digit
Item 22.1	Maintenance Section Number	Card 03	2 Digit
Item 23.1	Project Type	Card 03	1 Digit
Item 23.2	Job Description	Card 03	9 Digit
Item 26	Inventory Route Functional Classification	Card 03	Digits
Item 26A	Intersecting Route Functional Classification	Card 11	2 Digit
Item 27	Year Built	Card 03	2 Digit
Item 28	Lanes On and Under the Structure	Card 03	4 Digit
Item 29	Average Daily Traffic	Card 03	6 Digit
Item 29A	Intersecting Route Average Daily Traffic (ADT)	Card 11	6 Digit
Item 30	Year of Average Daily Traffic	Card 03	2 Digit
Item 30A	Intersecting Route Date of ADT	Card 11	2 Digit
Item 31	Design Load	Card 03	1 Digit
Item 32	Approach Roadway Width (XXX feet)	Card 03	3 Digit
Item 33	Bridge Median	Card 04	1 Digit
Item 34	Skew (XX Degrees)	Card 04	2 Digit
Item 35	Structure Flared	Card 04	1 Digit
Item 36	Traffic Safety Features	Card 04	4 Digit
Item 37	Historical Significance	Card 04	1 Digit
Item 38	Navigation Control	Card 04	1 Digit
Item 39	Navigation Vertical Clearance (XXX feet)	Card 04	3 Digit
Item 40	Navigation Horizontal Clearance (XXXX feet)	Card 04	4 Digit
Item 41	Structure Open, Posted, or Closed to Traffic	Card 04	1 Digit
Item 41.1	Loading Restriction	Card 04	1 Digit
Item 41.2	Load Restriction in Thousands Of Pounds	Card 04	3 Digit
Item 42	Type of Service	Card 04	2 Digit
Item 43	Structure Type		
Item 43.1	Main Span	Card 04	4 Digit
Item 43.2	Structure Type, Major Approach Spans	Card 04	4 Digit
Item 43.3	Structure Type, Minor Approach Spans	Card 04	4 Digit
Item 43.4	Structure Type, Culvert	Card 04	2 Digit
Item 43.5	Structure Type, Tunnel	Card 04	1 Digit
Item 44.1	Substructure Type, Main Spans	Card 04	3 Digit
Item 44.2	Substructure Type, Major Approach Spans	Card 04	3 Digit
Item 44.3	Substructure Type, Minor Approach Spans	Card 04	3 Digit
Item 45.1	Number of Main Spans	Card 05	3 Digit
Item 45.2	Number of Major Approach Spans	Card 05	3 Digit
Item 45.3	Number of Minor Approach Spans	Card 05	3 Digit
Item 46	Total Number of Spans	Card 05	4 Digit
Item 47	Inventory Route, Total Horizontal Clearance (XXX.X feet)	Card 05	4 Digit
Item 47A	Intersecting Route Horizontal Clearance (XXX.X feet)	Card 11	4 Digit
Item 48	Length of Maximum Span (XXXX feet)	Card 05	4 Digit
Item 49	Structure Length (XXXXXX feet)	Card 05	6 Digit
Item 50	Sidewalk Widths (XX.X feet, XX.X feet)	Card 07	6 Digit
Item 51	Bridge Roadway Width, Curb-to-Curb (XXX.X feet)	Card 05	4 Digit
Item 52	Deck Width, Out-to-Out (XXX.X feet)	Card 05	4 Digit
Item 53	Minimum Vertical Clearance Over Bridge Deck (XX feet, XX inches)	Card 05	4 Digit
Item 54	Minimum Vertical Underclearance (X code, XX feet, XX inches)	Card 05	5 Digit
Item 55	Minimum Lateral Underclearance on Right (X code, XX.X feet)	Card 05	4 Digit
Item 56	Minimum Lateral Underclearance on Left (XX.X feet) (for divided highway, 1-way streets, and ramps; not applicable to railroads)	Card 05	3 Digit
Item 58	Deck	Card 06	1 Digit
Item 59	Superstructure	Card 06	1 Digit
Item 60	Substructure	Card 06	1 Digit

Table 12. BRINSAP Data Fields (Continued).

Item No.	Item Name	Card Type	Number of Digits
Item 61	Channel and Channel Protection	Card 06	1 Digit
Item 62	Culverts	Card 06	1 Digit
Item 64	Operating Rating	Card 06	3 Digit
Item 65	Roadway Approach	Card 06	1 Digit
Item 66	Inventory Rating	Card 06	3 Digit
Item 67	Structural Evaluation	Card 06	1 Digit
Item 68	Deck Geometry	Card 06	1 Digit
Item 69	Underclearances, Vertical and Horizontal	Card 06	1 Digit
Item 70	Bridge Posting	Card 06	1 Digit
Item 71	Waterway Adequacy	Card 06	1 Digit
Item 72	Approach Roadway Alignment	Card 06	1 Digit
Item 75	Type of Work	Card 07	3 Digit
Item 76	Length of structure Improvement (XXXXXX feet)	Card 07	6 Digit
Item 88	Special Flags	Card 07	6 Digit
Item 88A	Underwater Inspection	Card 07	1 Digit
Item 88B	Fracture Critical Areas	Card 07	2 Digit
Item 88C	Steel Type	Card 07	1 Digit
Item 88D	Year Steel Painted	Card 07	2 Digit
Item 90	Inspection Date (mm-dd-yy)	Card 06	6 Digit
Item 91	Designated Inspection Frequency	Card 06	2 Digit
Item 92	Critical Feature Inspection	Card 06	9 Digit
Item 93	Critical Feature Inspection Date	Card 06	12 Digit
Item 94	Bridge Improvement Cost	Card 07	6 Digit
Item 95	Roadway Improvement Cost	Card 07	6 Digit
Item 96	Total Project Cost	Card 07	6 Digit
Item 97	Year of Improvement Cost Estimate	Card 07	2 Digit
Item 98	Border Bridge	Card 08	5 Digit
Item 99	Border Bridge Structure Number	Card 08	15 Digit
Item 100	Defense Highway Designation	Card 08	1 Digit
Item 100A	Intersecting Route Defense Highway Designation	Card 11	1 Digit
Item 101	Parallel Structure Designation	Card 08	1 Digit
Item 101A	Intersecting Route Parallel Structure	Card 11	1 Digit
Item 102	Direction of Traffic	Card 08	1 Digit
Item 102A	Intersecting Route Direction of Traffic	Card 11	1 Digit
Item 103	Temporary Structure Designation	Card 08	1 Digit
Item 103A	Intersecting Route Temporary Structure Designation	Card 11	1 Digit
Item 104	Highway System of the Inventory Route	Card 08	2 Digit
Item 104A	Intersecting Route Highway System	Card 11	2 Digit
Item 106	Year Reconstructed or Widened	Card 08	4 Digit
Item 106.1	Widening Code	Card 08	1 Digit
Item 107.1	Deck Structure Type, Main Span	Card 08	1 Digit
Item 107.2	Deck Structure Type, Major Approach Span	Card 08	1 Digit
Item 107.3	Deck Structure Type, Minor Approach Span	Card 08	1 Digit
Item 108.1	Wearing Surface/Protective System, Main Span	Card 08	3 Digit
Item 108.2	Wearing Surface/Protective System, Major Approach Span	Card 08	3 Digit
Item 108.3	Wearing Surface/Protective System, Minor Approach Span	Card 08	3 Digit
Item 109	Average Daily Truck Traffic (XX percent)	Card 08	2 Digit
Item 109A	Intersecting Route Average Daily Truck Traffic	Card 11	2 Digit
Item 110	Designated National Network	Card 08	1 Digit
Item 110A	Intersecting Route Designated National Network	Card 11	1 Digit
Item 111	Pier or Abutment Protection (for Navigation)	Card 08	1 Digit
Item 112	NBIS Bridge Length	Card 08	1 Digit
Item 113	Scour Critical Bridges	Card 08	1 Digit
Item 113.1	Scour Vulnerability	Card 08	1 Digit
Item 114	Future Average Daily Traffic	Card 09	6 Digit
Item 114A	Intersecting Route Future Average Daily Traffic (ADT)	Card 11	6 Digit

Table 12. BRINSAP Data Fields (Continued).

Item No.	Item Name	Card Type	Number of Digits
Item 115	Year of Future Average Daily Traffic	Card 09	2 Digit
Item 115A	Intersecting Route Year of Future Average Daily Traffic (ADT)	Card 11	2 Digit
Item 116	Minimum Navigation Vertical Clearance Vertical Lift Bridge (xxx feet)	Card 09	3 Digit
Item 119	Cost of Original Construction	Card 07	8 Digit
Item 120	Deficient/Obsolete Code	Card 09	1 Digit
Item 121	Sufficiency Rating	Card 09	4 Digit
Item 126	District Use Fields	Card 09	20 Digit
Item 127	Inventory Route Reason for Change	Card 12	1 Digit
Item 127A	Intersecting Route Reason for Change	Card 12	1 Digit
Item 128	Over Height Load Damage	Card 06	1 Digit
Item 12	Base Hwy Network	Card 13	1 Digit
Item 13.1	LRS Inventory Route	Card 13	10 Digit
Item 13.2	LRS Sub-route	Card 13	2 Digit
Item 12A	I.R. Base Hwy Network	Card 13	1 Digit
Item 13.1A	I.R. LRS Inventory Route	Card 13	10 Digit
Item 13.2A	I.R. LRS Sub-route	Card 13	2 Digit
Item 16.1	GPS Latitude	Card 13	11 Digit
Item 17.1	GPS Longitude	Card 13	12 Digit
Item 17.2	Method Collected	Card 13	1 Digit
Item 63	Method Operating Rate	Card 13	1 Digit
Item 65.1	Method Inventory Rate	Card 13	1 Digit
Item 105	Federal Lands Hwy	Card 13	1 Digit

Methods to access BRINSAP data outside of the mainframe include the following:

- **Microsoft Access®.** The BRINSAP application can export on- and off-system bridge data to text files, which then can be imported into a Microsoft Access template. Details of this procedure are provided in the TxDOT Bridge Inspection Manual (12).
- **ESRI® ArcGIS™.** The BRINSAP application can export bridge data to text files for load restricted bridges and for all bridges. A TxDOT script converts these text files to Geographic Information System (GIS) feature classes and stores these feature classes on an Oracle® server. TxDOT users can view, query, and analyze these feature classes in ArcGIS desktop.
- **Main Street Texas (MST).** TxDOT users can also view query, and analyze BRINSAP feature classes through MST. MST is a TxDOT intranet application that allows users to access agency spatial data without needing GIS software.

PONTEX

PonTex is a standalone client-server application developed by TxDOT for collecting and managing bridge inspection data (13). TxDOT inspects all on-system and off-system bridges in Texas and collects additional information beyond NBI requirements, such as data on all elements of a bridge (14). The PonTex interface consists of menu items and tabbed forms (Figure 1, Table 13). PonTex groups bridge inspection activities according to the following phases:

- **Assignment.** During this phase, a TxDOT bridge inspection office assigns a bridge for inspection to a contractor, which assigns the bridge to a team leader or subcontractor.
- **Inspection.** During this phase, the team leader enters and submits inspection results.
- **Review.** During this phase, the outside party and the district inspection office review the inspection.

PonTex

File Bridge Roadway Inspection Reports Tools Help

Structure Number:

Bridge List Identification Geometry Structure Loading Inventory Route Intersecting Route Inspection & Appraisal Programming Review Users

District: County: Maint Sec: Control: Section: Status:

Dist	Cnty	Maint Sect	Structure Number	Features Intersected	Facility Carried	Location	Reference Marker
15	007	16	15-007-0-0017-04-198	N PRONG ATASCOSA RIVER	IH 35 SB	0.10 MI SW OF BEXAR C/L	0133 +00345
15	007	16	15-007-0-0017-04-199	FM 2790	IH 35 NB	1.00 MI SW OF BEXAR C/L	0132 +00430
15	007	16	15-007-0-0017-04-200	FM 2790	IH 35 SB	1.00 MI SW OF BEXAR C/L	0132 +00430
15	007	16	15-007-0-0017-04-201	W PRONG ATASCOSA RIVER	IH 35 SB	0.10 MI NE OF FM 3175	0131 +00858
15	007	16	15-007-0-0017-04-202	W PRONG ATASCOSA RIVER	IH 35 NB	0.10 MI NE OF FM 3175	0131 +00858
15	007	16	15-007-0-0017-04-203	FM 3175	IH 35 SB	0.70 MI SW OF FM 2790	0131 +00768
15	007	16	15-007-0-0017-04-204	FM 3175	IH 35 NB	0.70 MI SW OF FM 2790	0131 +00785
15	007	16	15-007-0-0017-13-054	N PRONG ATASCOSA RIVER	SH 132	0.10 MI SW OF BEXAR C/L	0576 +00095
15	007	16	15-007-0-0017-13-056	KEARNY POND	SH 132	0.15 MI SW OF FM 2790	0576 +01112
15	007	09	15-007-0-0073-03-006	GALVAN CREEK	US 281 SB	1.95 MI N OF FM 3006	0570 +01138
15	007	09	15-007-0-0073-03-023	ATASCOSA RIVER	US 281	0.30 MI NE OF FM 3350	0576 +00432
15	007	09	15-007-0-0073-03-085	DRAW	US 281	0.10 MI N OF FM 1470	0568 +01107
15	007	09	15-007-0-0073-03-086	GALVAN CREEK	US 281 NB	1.95 MI N OF FM 3006	0570 +01152
15	007	09	15-007-0-0073-04-008	BONITA CREEK RELIEF	US 281	0.05 MI S OF SH 97	0578 -00979
15	007	09	15-007-0-0073-04-009	BONITA CREEK	US 281	0.10 MI S OF SH 97	0578 -01034
15	007	09	15-007-0-0073-04-258	-1	-1	-1	0
15	007	-1	15-007-0-0073-05-010	-1	-1	-1	0
15	007	-1	15-007-0-0073-05-011	-1	-1	-1	0
15	007	09	15-007-0-0073-05-013	UPRR	IH 37 WFR	2.30 MI NW OF FM 791	0092 +00739

Retrieve New Edit Delete Sort Select All

Bridge List Clicked

Figure 1. PonTex Version 1.10 Interface (13).

Table 13. PonTex Tab Forms (13).

Tab Name	Tab Description
Bridge List	This tab contains a list of all bridges and associated data accessible to a specific user.
Identification	These tabs contain permanent structure data, such as location, age, service, and management.
Geometry	
Structure	
Loading	
Programming	
Inventory Route	This tab contains data for the inventory route such as federal system classification and traffic data.
Intersecting Route	This tab contains data for the intersecting route (if it exists), such as federal system classification.
Inspection & Appraisal	This tab contains inspection data, such as condition ratings, inspection histories, and appraisal ratings.
Review	This tab allows an authorized user to accept or reject database changes, such as blocked fields, changed fields, deleted bridges, renamed bridges, renamed routes, submitted and rejected inspections.
Users	This tab contains PonTex user data, such as roles, and contact information.
Assignments*	This tab contains assignments to bridge inspectors, contractors, subcontractors, and team leaders.
Company*	This tab contains data for companies performing bridge inspections.
Components*	This tab contains bridge inspection component and element data. Components include abutments, approaches, bents, culverts, and spans.
Contracts*	This tab contains bridge inspection contract data, such as work authorizations, team leaders, and subcontractors.
Element Condition*	This tab contains the condition for each individual TxDOT or NBI bridge element.

* Indicates a second-level tab not shown in Figure 1.

Figure 2 shows a high-level view of the PonTex physical data model (15). This model is an adaptation of the Pontis database schema (16). The following section describes Pontis in more detail. PonTex uses modified versions of the following three Pontis tables:

- **INSPEVNT.** In PonTex this table contains one record for each structure inspection, including the inspection type, inspector identification, and structure level inspection results. This table contains attributes from the Pontis INSPEVNT table with no modifications.
- **USERBRDG.** In PonTex this table contains agency-defined bridge-level data (Table 14). This table contains attributes, data types, and definitions from the Pontis USERBRDG and BRIDGE tables, as well as several TxDOT-defined attributes. Many of these additional TxDOT attributes are used in the Permanent Structure Number application, described later, and include data elements such as structure function, service type, and control section numbers for main, adjacent, and crossing roadways and culverts.
- **USERRWAY.** In PonTex this table contains agency-defined roadway-level data. This table contains attributes from the Pontis USERRWAY and ROADWAY tables, as well as TxDOT-defined attributes, such as control number, section number, and job number.

Table 14. PonTex USERBRDG Data Fields (Continued).

Name	Data Type	Definition
DISTRICT	VARCHAR(2)	Highway agency district
DKMEMBTYPE	CHAR(1)	Deck membrane type
DKPROTECT	CHAR(1)	Deck protection
DKSTRUCTYP	CHAR(1)	Deck structure type
DKSURFTYPE	CHAR(1)	Deck surface type
FACILITY	VARCHAR(18)	Facility Carried
FEATINT	VARCHAR(24)	
FHWA_REGN	CHAR(1)	FHWA Region
FIPS_STATE	VARCHAR(2)	Federal Information Processing Standard (FIPS) State
GPS_COLLN_MTHD	CHAR(1)	
HCLRULT	FLOAT	Minimum lateral underclearance on left
HCLRURT	FLOAT	Minimum lateral underclearance on right
HISTSIGN	CHAR(1)	Historical Significance
IMPLEN	FLOAT	Length of structure improvement
INITIAL_LOAD_DT	DATE	
INV_RTNG_LD_CD	CHAR(1)	
IR_KEY_CHNG_RESN_CD	CHAR(1)	
IRLOAD	FLOAT	Inventory rating load
IRTYPE	CHAR(1)	Inventory rating type
JOB	CHAR(3)	
KEY_CHNG_RESN_CD	CHAR(1)	
LAND_LOCK_FLAG	CHAR(1)	
LANES_ON_STRUC	CHAR(2)	
LANES_UNDER_STRUC	CHAR(2)	
LASTINSP	DATE	
LATITUDE	NUMBER(8,2)	Latitude
LD_RSTRCN	FLOAT	
LENGTH	FLOAT	Structure Length
LFTBRNAVCL	FLOAT	Minimum navigation vertical clearance
LFTCURBSW	FLOAT	Left curb side walk width
LOCATION	VARCHAR(25)	Location
LONGITUDE	NUMBER(9,2)	Longitude
MAIN_SPAN_MEMB	VARCHAR(2)	
MAIN_SPAN_RDWAY	CHAR(1)	
MAIN_SPAN_TYPE	CHAR(1)	
MAINSPANS	NUMBER(3)	Number of main spans
MAINT_SECT_NBR	VARCHAR(2)	
MAJ_ASPAN_MEMB	VARCHAR(2)	
MAJ_ASPAN_RDWAY	CHAR(1)	
MAJ_ASPAN_TYPE	CHAR(1)	
MAJ_ASPN_SUB_ABV	CHAR(1)	
MAJ_ASPN_SUB_BLW	CHAR(1)	
MAJ_ASPN_SUB_CAP	CHAR(1)	
MAJR_APRCH_QTY	NUMBER(3)	
MAXSPAN	FLOAT	Length of maximum span
MIN_ASPAN_MEMB	VARCHAR(2)	
MIN_ASPAN_RDWAY	CHAR(1)	
MIN_ASPAN_TYPE	CHAR(1)	
MIN_ASPN_SUB_ABV	CHAR(1)	
MIN_ASPN_SUB_BLW	CHAR(1)	

Table 14. PonTex USERBRDG Data Fields (Continued).

Name	Data Type	Definition
MIN ASPN SUB CAP	CHAR(1)	
MINR APRCH QTY	NUMBER(3)	
MN SPAN SUB ABV	CHAR(1)	
MN SPAN SUB BLW	CHAR(1)	
MN SPAN SUB CAP	CHAR(1)	
MODTIME	DATE	Time the record was last modified. Reserved for future use.
N FHWA REG	CHAR(1)	
NAVCNTROL	CHAR(1)	Navigation Control
NAVHC	FLOAT	Navigation horizontal Clearance
NAVVC	FLOAT	Navigation vertical clearance
NBIIMPCOST	NUMBER(9)	Cost of proposed action - construction portion only
NBIRWCOST	NUMBER(9)	Right of way cost for proposed action
NBISLEN	CHAR(1)	NBIS Length Met
NBITOTCOST	NUMBER(9)	NBI total cost
NBIYRCOST	NUMBER(4)	Year of Improvement Cost Estimate
NSTATECODE	VARCHAR(3)	Neighbor state code of a border bridge
ON_OFF_SYS	VARCHAR(1)	Flag indicates whether bridge is on or off the system of the agency. Usually but not always determined as a function of bridge owner.
OPR RTNG LD_CD	CHAR(1)	
OPRTL STAT_CD	CHAR(1)	
ORLOAD	FLOAT	Operating rating load
ORTYPE	CHAR(1)	Method Used to Determine Operating Rating
OWNER	VARCHAR(2)	Owner
PARALSTRUC	CHAR(1)	Parallel Structure
PLACECODE	VARCHAR(5)	Place Code
POSTING	CHAR(1)	Bridge Posting
PREV IR STRUC_FUNC_CD	CHAR(1)	
PREV IR STRUC ID	VARCHAR(10)	
PREV STRUC_FUNC_CD	CHAR(1)	
PREV STRUC ID	VARCHAR(10)	
PROJ_FUND_TYPE	CHAR(1)	
PROPWORK	VARCHAR(2)	Proposed Work
REFHUC	CHAR(1)	Reference feature for lateral underclearance
REFVUC	CHAR(1)	Reference feature for underclearance measurement
RSTRCN_CD	CHAR(1)	
RTCURBSW	FLOAT	Right curb side walk width
SECTION	CHAR(2)	
SERVTYPEPON	CHAR(1)	Type of service on bridge
SERVTYPEPUND	CHAR(1)	Type of service under bridge
SKEW	NUMBER(2)	Skew
SRSTATUS	CHAR(1)	Bridges where SR status has changed
STRFLARED	CHAR(1)	Structure flared
STRUC_COST	NUMBER(8)	
STRUC_FUNC_CD	CHAR(1)	
STRUC_LAT	NUMBER(11,8)	
STRUC_LON	NUMBER(11,8)	
STRUCNAME	VARCHAR(50)	Agency structure name
STRUCT_NUM	VARCHAR(15)	FHWA Structure Number - NBI 8
TEMPSTRUC	CHAR(1)	Temporary structure designation

Table 14. PonTex USERBRDG Data Fields (Continued).

Name	Data Type	Definition
TUN_STRUC_CD	CHAR(1)	
TX_CHECKED_OUT	VARCHAR(20)	
TX_LAST_UPDT_DT	DATE	
TX_LAST_UPDT_USER	VARCHAR(20)	
TX_RUN_DATE	CHAR(6)	
TX_STATUS	VARCHAR(20)	
TX_VALID	VARCHAR(20)	
USERKEY	VARCHAR(4)	Primary key to the users table. Key of user that last modified record.
VCLROVER	FLOAT	Minimum vertical clearance over bridge roadway
VCLRUNDER	FLOAT	Minimum vertical underclearance
WEAR_PROT_MAJR	CHAR(1)	
WEAR_PROT_MINR	CHAR(1)	
WEAR_SRFC_MAJR	CHAR(1)	
WEAR_SRFC_MINR	CHAR(1)	
WEAR_WPROF_MAJR	CHAR(1)	
WEAR_WPROF_MINR	CHAR(1)	
WHN_BLT_CTR_NBR	VARCHAR(4)	
WHN_BLT_JOB_NBR	VARCHAR(4)	
WHN_BLT_SCT_NBR	VARCHAR(4)	
WIDENING_CD	CHAR(1)	
WORKBY	CHAR(1)	Work done by
YEARBUILT	NUMBER(4)	Year built
YEARRECON	NUMBER(4)	Year reconstruction

Note: blank definitions indicate null description values in available technical documentation.

PonTex data reside on Oracle servers hosted by TSD. As opposed to BRINSAP, PonTex can store elemental bridge data collected during bridge inspections. Currently, PonTex does not accept inspection imagery or digital signatures in connection with online inspection report submissions. TxDOT expects future versions of PonTex to include inspection contract management data, which are currently stored separately. PonTex is accessible to TxDOT internal users through Microsoft Windows® terminal services and to external consultants through Citrix® products.

TxDOT's plan is to phase out BRINSAP when PonTex is implemented statewide. However, TxDOT will maintain BRINSAP data, with updates from the TxDOT version of the Pontis database, since other TxDOT legacy systems use BRINSAP data.

PONTIS

Pontis is a bridge management system that FHWA developed in the late 1980s. Currently, Pontis is part of the American Association of State Highway and Transportation Officials (AASHTO) BRIDGEWare product suite, whose development contractor is Michael Baker Jr., Inc (17). The current version of Pontis is 5.1. Pontis 5.2 is under development and is expected to be developed in 2012.

Pontis describes bridges using structural elements, such as girders, stringers, and beams; truss components; arches; pin and hanger assemblies; decks and deck slabs; railings and traffic barriers; deck joints; bearings; piers and columns; abutments, approach slabs, and wing walls; and footings and pilings. Pontis includes structure condition, preservation treatments or actions, bridge deterioration models, cost modules, and environmental conditions for each structural element. By comparison, NBI describes bridges using more generic components, such as superstructure, substructure, and deck. Pontis includes the following modules (16):

- **Inspection module.** This module handles the review and analysis of bridge data, including bridge inventory and inspection data. Figure 3 shows the interface for this module.
- **Project Planning Module.** This module provides tools for project development. These tools include identification of structure needs, analysis of future structure performance based on work type, project scheduling of individual structures, create budget-constrained programs of structure projects, and record project completion information.
- **Programming Module.** This module sets up structure improvement policies and standards, and runs simulations of alternative multi-year, budget-constrained program scenarios.
- **Preservation Module.** This module develops and runs models for optimal long-term preservation policies that minimize life cycle costs and risk of element failures.
- **Results Module.** This module provides graphical reports of predicted network costs and performance associated with different scenarios and project programs.
- **Gateway Module.** This module imports and exports data between Pontis and other systems.
- **Configuration Module.** This module customizes Pontis according to individual agency needs.

Pontis 4.3.1 - You are currently logged in as PONTIS

File View Tools Window Help

Desktop - Inspection

Inspection Layout Count Find... Select... Save... Select All Just Selected

Rows 1 to 28 of 1432 Layout: -- Default Structure Layout --

Bridge ID	Feature Intersected	Dist	Cnty	Own	Maint.	Area	Meters	Built	Structure Nam
1001 279	BRANDYWINE CREEK	orth Distri	3 New Castl	State Highway Agen	State Highway Agen	02	39	1928	1
1001A279	BRANDYWINE CREEK	orth Distri	3 New Castl	State Highway Agency	State Highway Agency	02	8	1900	-1
1001B009	WATERWAY	orth Distri	3 New Castl	State Highway Agency	State Highway Agency	02	9	1919	-1
1002 232	BRANDYWINE CREEK	orth Distri	3 New Castl	State Highway Agency	State Highway Agency	02	50	1933	-1
1003 225	BRANDYWINE CREEK	orth Distri	3 New Castl	State Highway Agency	State Highway Agency	02	59	1990	THOMPSON'S I
1004P000	RD 50 NORTHEAST BL	orth Distri	3 New Castl	City/Municipal Hwy Ag	City/Municipal Hwy Ag	00	31	1972	-1
1005P000	RD 19 NEW CASTLE A	orth Distri	3 New Castl	City/Municipal Hwy Ag	City/Municipal Hwy Ag	00	31	1972	-1
1006P000	SR 2	orth Distri	3 New Castl	City/Municipal Hwy Ag	City/Municipal Hwy Ag	00	31	1972	-1
1007P000	RD 358 OGLETOWN RD	orth Distri	3 New Castl	26 Private(nonRailroad	26 Private(nonRailroad	00	54	1987	MBNA PEDEST
1008 221	BEAVER VALLEY CRE	orth Distri	3 New Castl	State Highway Agency	State Highway Agency	02	13	1960	-1
1009 221	BRANDYWINE CREEK	orth Distri	3 New Castl	State Highway Agency	State Highway Agency	02	42	1900	SMITH'S BRIDG
1010P000	I 495, RD 60	orth Distri	3 New Castl	State Highway Agency	31 State Toll Authority	99	182	1982	-1
1011N267	RD 232, ROCKLAND R	orth Distri	3 New Castl	State Highway Agency	State Highway Agency	02	17	1997	-1
1011S267	RD 232, ROCKLAND R	orth Distri	3 New Castl	State Highway Agency	State Highway Agency	02	17	1997	-1
1012 223	HURRICANE RUN	orth Distri	3 New Castl	State Highway Agency	State Highway Agency	02	4	1900	-1
1013P000	I 495	npike Dist	3 New Castl	State Highway Agency	31 State Toll Authority	99	137	1975	-1
1014 221	BEAVER VALLEY CRE	orth Distri	3 New Castl	State Highway Agency	State Highway Agency	02	10	1962	-1
1016 221	BEAVER VALLEY CRE	orth Distri	3 New Castl	State Highway Agency	State Highway Agency	02	8	1988	-1
1017 221	BEAVER VALLEY CRE	orth Distri	3 New Castl	State Highway Agency	State Highway Agency	02	7	1987	-1
1018 221	BEAVER VALLEY CRE	orth Distri	3 New Castl	State Highway Agency	State Highway Agency	02	7	1987	-1
1019 232	WATERWAY	orth Distri	3 New Castl	State Highway Agency	State Highway Agency	02	2	1900	-1
1020 232	HUSBAND RUN	orth Distri	3 New Castl	State Highway Agency	State Highway Agency	02	8	1932	-1
1022 229	WILLOW RUN	orth Distri	3 New Castl	State Highway Agency	State Highway Agency	02	4	1957	-1
1023A231	READING RR	orth Distri	3 New Castl	State Highway Agency	State Highway Agency	02	20	1918	-1
1024 004	ROCKY RUN	orth Distri	3 New Castl	State Highway Agency	State Highway Agency	02	9	1987	-1
1025 004	WATERWAY	orth Distri	3 New Castl	State Highway Agency	State Highway Agency	02	4	1941	-1
1026 203	NAAMANS CREEK	orth Distri	3 New Castl	State Highway Agency	State Highway Agency	01	17	1965	-1
1027P000	US 13	orth Distri	3 New Castl	State Highway Agency	State Highway Agency	05	58	1973	-1

1432 structures were retrieved.

Training (pontis)

N/A

03/04/2005

Figure 3. Screen Capture of Pontis Inspection Module (18).

Pontis uses a relational database schema that groups data into the following categories (19, 20):

- **Physical inventory.** These tables support the Pontis Inspection Module and include data such as bridges, roadways, inspection events, and element inspections. As an illustration, Table 15 provides a list of Pontis bridge table attributes. Attributes shown in *italics* indicate attributes also contained in the PonTex USERBRDG table (Table 14).
- **Program simulation.** These tables support the Pontis Program simulation module and include data such as scenarios, scenario parameters, agency policy rules, rehabilitation rules, and scope rules.
- **Project planning.** These tables support the Pontis Project planning module and include data such as projects, project funding sources, and programs.
- **Definition tables.** These tables include definitions for elements, materials, and costs.
- **System tables.** These tables include user information, preferences, and logs.

Table 15. Pontis Bridge Data Fields (20, 21).

Name	Datatype	Definition
<i>BRKEY</i>	<i>VARCHAR(15)</i>	<i>Primary Pontis structure key--uniquely identifies the structure in the system.</i>
<i>BRIDGE ID</i>	<i>VARCHAR(30)</i>	<i>Agency Bridge ID - Entered by agency</i>
<i>STRUCT NUM</i>	<i>VARCHAR(15)</i>	<i>FHWA Structure Number - NBI 8</i>
<i>STRUCNAME</i>	<i>VARCHAR(50)</i>	<i>Agency structure name</i>
<i>FEATINT</i>	<i>VARCHAR(24)</i>	
<i>FHWA REGN</i>	<i>CHAR(1)</i>	<i>FHWA Region</i>
<i>DISTRICT</i>	<i>VARCHAR(2)</i>	<i>Highway agency district</i>
<i>COUNTY</i>	<i>VARCHAR(3)</i>	<i>County</i>
<i>FACILITY</i>	<i>VARCHAR(18)</i>	<i>Facility Carried</i>
<i>LOCATION</i>	<i>VARCHAR(25)</i>	<i>Location</i>
<i>CUSTODIAN</i>	<i>VARCHAR(2)</i>	<i>Custodian</i>
<i>OWNER</i>	<i>VARCHAR(2)</i>	<i>Owner</i>
<i>ADMINAREA</i>	<i>VARCHAR(2)</i>	<i>Geographic stratification--administrative area--of a state</i>
<i>BRIDGEGROUP</i>	<i>VARCHAR(20)</i>	<i>Agency defined bridge group for a bridge. Used to group sets of bridges for assignment to inspectors or for other review purposes. Not unique</i>
<i>NSTATECODE</i>	<i>VARCHAR(3)</i>	<i>Neighbor state code of a border bridge</i>
<i>N FHWA REG</i>	<i>CHAR(1)</i>	
<i>BB PCT</i>	<i>NUMBER(2)</i>	<i>Percent in other state</i>
<i>BB BRDGEID</i>	<i>VARCHAR(15)</i>	<i>Border bridge ID</i>
<i>PROPWORK</i>	<i>VARCHAR(2)</i>	<i>Proposed Work</i>
<i>WORKBY</i>	<i>CHAR(1)</i>	<i>Work done by</i>
<i>NBIIMPCOST</i>	<i>NUMBER(9)</i>	<i>Cost of proposed action - construction portion only</i>
<i>NBIRWCOST</i>	<i>NUMBER(9)</i>	<i>Right of way cost for proposed action</i>
<i>NBITOTCOST</i>	<i>NUMBER(9)</i>	<i>NBI total cost</i>
<i>NBIYRCOST</i>	<i>NUMBER(4)</i>	<i>Year of Improvement Cost Estimate</i>
<i>YEARBUILT</i>	<i>NUMBER(4)</i>	<i>Year built</i>
<i>YEARRECON</i>	<i>NUMBER(4)</i>	<i>Year reconstruction</i>
<i>HISTSIGN</i>	<i>CHAR(1)</i>	<i>Historical Significance</i>
<i>DESIGNLOAD</i>	<i>CHAR(1)</i>	<i>Live load for which the structure was designed</i>
<i>SERVTYPEPON</i>	<i>CHAR(1)</i>	<i>Type of service on bridge</i>
<i>SERVTYPEPUND</i>	<i>CHAR(1)</i>	<i>Type of service under bridge</i>
<i>SUMLANES</i>	<i>NUMBER(2)</i>	<i>Sum of all lanes for all NBI routes passing under the structure</i>
<i>MAINSPANS</i>	<i>NUMBER(3)</i>	<i>Number of main spans</i>
<i>APPSPANS</i>	<i>NUMBER(4)</i>	<i>Number of approach spans</i>
<i>MAXSPAN</i>	<i>FLOAT</i>	<i>Length of maximum span</i>
<i>LENGTH</i>	<i>FLOAT</i>	<i>Structure Length</i>
<i>DECK AREA</i>	<i>FLOAT</i>	<i>Deck Area</i>
<i>BRIDGEMED</i>	<i>CHAR(1)</i>	<i>Bridge Median</i>
<i>SKEW</i>	<i>NUMBER(2)</i>	<i>Skew</i>
<i>MATERIALMAIN</i>	<i>CHAR(1)</i>	<i>Material</i>
<i>DESIGNMAIN</i>	<i>VARCHAR(2)</i>	<i>Design</i>
<i>MATERIALAPPR</i>	<i>CHAR(1)</i>	<i>Material of the approach span</i>
<i>DESIGNAPPR</i>	<i>VARCHAR(2)</i>	<i>Design of the approach span</i>
<i>DKSTRUCTYP</i>	<i>CHAR(1)</i>	<i>Deck structure type</i>
<i>DKMEMBTYP</i>	<i>CHAR(1)</i>	<i>Deck membrane type</i>
<i>DKSURFTYP</i>	<i>CHAR(1)</i>	<i>Deck surface type</i>
<i>DKPROTECT</i>	<i>CHAR(1)</i>	<i>Deck protection</i>
<i>DECKWIDTH</i>	<i>FLOAT</i>	<i>Deck width, Out-to-Out</i>

Table 15. Pontis Bridge Data Fields (Continued).

Name	Datatype	Definition
<i>LFTCURBSW</i>	<i>FLOAT</i>	<i>Left curb side walk width</i>
<i>RTCURBSW</i>	<i>FLOAT</i>	<i>Right curb side walk width</i>
<i>STRFLARED</i>	<i>CHAR(1)</i>	<i>Structure flared</i>
<i>REFVUC</i>	<i>CHAR(1)</i>	<i>Reference feature for under-clearance measurement</i>
<i>REFHUC</i>	<i>CHAR(1)</i>	<i>Reference feature for lateral under-clearance</i>
<i>HCLRURT</i>	<i>FLOAT</i>	<i>Minimum lateral under-clearance on right</i>
<i>HCLRULT</i>	<i>FLOAT</i>	<i>Minimum lateral under-clearance on left</i>
<i>LFTBRNAVCL</i>	<i>FLOAT</i>	<i>Minimum navigation vertical clearance</i>
<i>NAVCONTROL</i>	<i>CHAR(1)</i>	<i>Navigation Control</i>
<i>NAVHC</i>	<i>FLOAT</i>	<i>Navigation horizontal Clearance</i>
<i>NAVVC</i>	<i>FLOAT</i>	<i>Navigation vertical clearance</i>
<i>PARALSTRUC</i>	<i>CHAR(1)</i>	<i>Parallel Structure</i>
<i>TEMPSTRUC</i>	<i>CHAR(1)</i>	<i>Temporary structure designation</i>
<i>NBISLEN</i>	<i>CHAR(1)</i>	<i>NBIS Length Met</i>
<i>LATITUDE</i>	<i>NUMBER(8,2)</i>	<i>Latitude</i>
<i>LONGITUDE</i>	<i>NUMBER(9,2)</i>	<i>Longitude</i>
<i>VCLROVER</i>	<i>FLOAT</i>	<i>Minimum vertical clearance over bridge roadway</i>
<i>VCLRUNDER</i>	<i>FLOAT</i>	<i>Minimum vertical under-clearance</i>
<i>PLACECODE</i>	<i>VARCHAR(5)</i>	<i>Place Code</i>
<i>IMPLEN</i>	<i>FLOAT</i>	<i>Length of structure improvement</i>
<i>FIPS_STATE</i>	<i>VARCHAR(2)</i>	<i>FIPS State</i>
<i>TOT_LENGTH</i>	<i>FLOAT</i>	<i>Total length</i>
<i>NEXTINSPID</i>	<i>VARCHAR(4)</i>	<i>Userkey of the person who will do the next inspection</i>
<i>CREWHRS</i>	<i>NUMBER(5,2)</i>	<i>Number of crew hours required for an inspection</i>
<i>FLAGGERHRS</i>	<i>NUMBER(5,2)</i>	<i>Number of flagger hours required for an inspection</i>
<i>HELPERHRS</i>	<i>NUMBER(5,2)</i>	<i>Number of helper hours required for an inspection</i>
<i>SNOOPERHRS</i>	<i>NUMBER(5,2)</i>	<i>Number of snoopers hours required for an inspection</i>
<i>SPCREWHRS</i>	<i>NUMBER(5,2)</i>	<i>Number of special crew hours required for an inspection</i>
<i>ON_OFF_SYS</i>	<i>VARCHAR(1)</i>	<i>Flag indicates whether bridge is on or off the system of the agency. Usually but not always determined as a function of bridge owner.</i>
<i>RATINGDATE</i>	<i>DATE</i>	<i>Date Load Rated</i>
<i>RATER_INI</i>	<i>VARCHAR(3)</i>	<i>Load Rater/Engineer Responsible</i>
<i>ORLOAD</i>	<i>FLOAT</i>	<i>Operating rating load</i>
<i>ORTYPE</i>	<i>CHAR(1)</i>	<i>Method Used to Determine Operating Rating</i>
<i>IRLOAD</i>	<i>FLOAT</i>	<i>Inventory rating load</i>
<i>IRTYPE</i>	<i>CHAR(1)</i>	<i>Inventory rating type</i>
<i>POSTING</i>	<i>CHAR(1)</i>	<i>Bridge Posting</i>
<i>REQ_OP_RAT</i>	<i>NUMBER(2)</i>	<i>Required Operating Rating</i>
<i>DEF_OP_RAT</i>	<i>CHAR(1)</i>	<i>Deficiency Operating Rating Flag</i>
<i>FC_DETAIL</i>	<i>VARCHAR(5)</i>	<i>FC Detail on Structure</i>
<i>ALTORLOAD</i>	<i>FLOAT</i>	<i>Alternate Load Rating</i>
<i>ALTORMETH</i>	<i>VARCHAR(4)</i>	<i>Alternate Operating Rating Method</i>
<i>ALTIRLOAD</i>	<i>FLOAT</i>	<i>Alternate Inventory Load Rating</i>
<i>ALTIRMETH</i>	<i>VARCHAR(4)</i>	<i>Alternate Inventory Rating Method</i>
<i>OTHERLOAD</i>	<i>FLOAT</i>	<i>Other load rating</i>
<i>TRUCK1OR</i>	<i>FLOAT</i>	<i>Operating rating for truck type 1</i>
<i>TRUCK2OR</i>	<i>FLOAT</i>	<i>Operating rating for truck type 2</i>
<i>TRUCK3OR</i>	<i>FLOAT</i>	<i>Operating rating for truck type 3</i>
<i>TRUCK1IR</i>	<i>FLOAT</i>	<i>Inventory rating for truck type 1</i>
<i>TRUCK2IR</i>	<i>FLOAT</i>	<i>Inventory rating for truck type 2</i>

Table 15. Pontis Bridge Data Fields (Continued).

Name	Datatype	Definition
TRUCK3IR	FLOAT	Inventory rating for truck type 3
<i>SRSTATUS</i>	<i>CHAR(1)</i>	<i>Bridges where SR status has changed</i>
USERKEY1	VARCHAR(30)	User defined key fields
USERKEY2	VARCHAR(30)	User defined key fields
USERKEY3	VARCHAR(30)	User defined key fields
USERKEY4	VARCHAR(30)	User defined key fields
USERKEY5	VARCHAR(30)	User defined key fields
USERKEY6	VARCHAR(30)	User defined key fields
USERKEY7	VARCHAR(30)	User defined key fields
USERKEY8	VARCHAR(30)	User defined key fields
USERKEY9	VARCHAR(30)	User defined key fields
USERKEY10	VARCHAR(30)	User defined key fields
USERKEY11	VARCHAR(30)	User defined key fields
USERKEY12	VARCHAR(30)	User defined key fields
USERKEY13	VARCHAR(30)	User defined key fields
USERKEY14	VARCHAR(30)	User defined key fields
USERKEY15	VARCHAR(30)	User defined key fields
BTRIGGER	CHAR(1)	Flag to trigger missing value formulas
TRACEFLAG	CHAR(1)	When checked, bridge is traced in log file during program simulation routine.
CREATEDATETIME	DATE	
CREATEUSERKEY	VARCHAR(4)	
<i>MODTIME</i>	<i>DATE</i>	<i>Time the record was last modified. Reserved for future use.</i>
<i>USERKEY</i>	<i>VARCCHAR(4)</i>	<i>Primary key to the users table. Key of user that last modified record.</i>
DOCREFKY	VARCHAR(255)	Document reference key
NOTES	VARCHAR(2000)	Entry comments
<i>TX STATUS</i>	<i>VARCCHAR(20)</i>	
<i>TX CHECKED OUT</i>	<i>VARCCHAR(20)</i>	
<i>TX VALID</i>	<i>VARCCHAR(20)</i>	

Note: Data fields in italics are also contained in the PonTex USERBRDG table.

Although many states have Pontis licenses (22), it is common for agencies to customize Pontis to meet their needs. Pontis allows some customization of bridge element and bridge action definitions and classifications, cost indices, data processing formulas, user interfaces, user privileges, data input forms and reports. TxDOT has a Pontis license, but the agency has not used Pontis other than for providing tables to the data model needed to support the development of PonTex. Concerns about the current version of Pontis include the following:

- TxDOT does not have access to Pontis source code, which affects the agency's ability to customize the application to meet TxDOT's needs.
- Pontis does not have deterioration models for states with very large north-south and east-west spans and considerable weather variety such as Texas.
- TxDOT needs to test Pontis to determine if the system can handle the number of bridges located in Texas.
- TxDOT needs to test Pontis for user friendliness and stability.

In the short term, TxDOT plans to continue to use PonTex. When the new version of Pontis is released, TxDOT plans to evaluate its functionality for items such as functions to model bridge deterioration and prediction of future conditions. Realistically, most users will still interact with PonTex for data collection, but Pontis will provide the tools for analysis and planning. If TxDOT adopts the new Pontis version, the agency will need to address the issue of whether to modify the database schema that is currently providing support to PonTex.

FINANCIAL INFORMATION MANAGEMENT SYSTEM

FIMS, which runs on an Adabas platform, records TxDOT accounting events and is the basis for all official departmental financial information (23). In addition to DCIS and MMIS, FIMS interfaces with other TxDOT systems such as the Contract Information System (CIS), CMCS, MSMS, and EOS. FIMS includes the following segment files (23):

- Segment 01 (FIMS-CSH01) – Cash,
- Segment 02 (FIMS-LTY0229) – Bank Retainage Deposits,
- Segment 04 (FIMS-REC04) – Accounts Receivable/Task Reimbursement,
- Segment 07 (FIMS-REC07) – Accounts Receivable/Miscellaneous,
- Segment 09 (FIMS-LTY09) – Warehouse Stock,
- Segment 10 (FIMS-LTY1011) – Capitalized Equipment,
- Segment 12 (FIMS-BAL12) – Buildings and Land,
- Segment 25 (FIMS-VOUCHERS) – Online Cash Voucher Data Entry,
- Segment 25 (FIMS-VPP) – Vouchers Payable,
- Segment 26 (FIMS-LTY26) – Accounts Payable,
- Segment 27 (FIMS-REC27) – Funds in Trust,
- Segment 29 (FIMS-LTY0229) – Retainage Liabilities,
- Segment 30 (FIMS-LTY30) – Payroll Deduction,
- Segment 31 (FIMS-LTY31) – Miscellaneous Deduction,
- Segment 41 (FIMS-ENC41) – Miscellaneous Contract,
- Segment 45 (FIMS-EQT) – Fund Balance,
- Segment 48 (FIMS-EQT) – Reserve for Investment in Inventories and Capitalized Assets,
- Segment 49 (FIMS-EQT) – Reserve for Accrued Un-billable Costs,
- Segment 60 (FIMS-CSH60) – Cash Receipts Revenue,
- Segment 61 (FIMS-CSH61) – Revenue Earned/Not Collected,
- Segment 70 (FIMS-CLR70) – Clearing Accounts,
- Segment 71 (FIMS-FUN71) – Functional Expenditure,
- Segment 72 (FIMS-RES72) – Research,
- Segment 74 (FIMS-PUB74) – Public Transportation,
- Segment 76 (FIMS-CNS76) – Construction and Maintenance Projects,
- Segment 77 (FIMS-CNS76) – Special Maintenance and Facility Projects,
- Segment 78 (FIMS-RMT78) – Routine Maintenance,
- Segment 79 (FIMS-OFF79) – Traffic Safety, and
- Segment 99 (FIMS-GEN99) – General Ledger.

Of particular interest are the following segment files:

- **Segment 76 (FIMS-CNS76) – Construction and Maintenance Projects.** This segment contains financial data for highway construction projects and maintenance projects managed using construction program procedures (24). Input data for this segment is DCIS cost data. Table 16 lists Segment 76 data fields. Of these fields, FUNCTION and OBJECT-EXP (Object of Expenditure) are of special significance. The FUNCTION field indicates the type of work financed by a specific fund. The OBJECT-EXP field indicates the types of goods or services purchased or consumed for the work type specified by the FUNCTION field. For example, Function Code 170 includes bridge inspection. Expenditure Object Code 134 includes allowances for underwater bridge inspection.
- **Segment 78 (FIMS-RMT78) – Routine Maintenance.** This segment contains direct expenses and associated indirect costs for routine roadway maintenance (25). MMIS cost data are an input for this file. Table 17 lists Segment 78 data fields. Of these fields, FUNCTION and OBJECT-EXP (Object of Expenditure) are of special significance. Segment 78 function codes differ from Segment 76 function codes. Segment 78 function codes for bridges are similar to MMIS function codes shown in Table 8. Object of Expenditure codes are the same in Segment 78 and Segment 76.

Table 16. FIMS Segment 76 (FIMS-CNS76) Data Fields (24).

Field	Field	Field
AMOUNT-TIME-INFO	HIGHWAY-NUMBER	PROJECT-NO
AUTHORITY-DESCR	ID-FILLER-FIELD	PRORATE-CHARGES-FLAG
BIRA-DCMNT-CMNT	IE-FILLER-FIELD	RURAL-CODE
BIRA-DCMNT-FY-YY-DT	INDICATOR-INFO	SEGMENT-ID
BIRA-DCMNT-SEQN-NBR	INVOICE-DESCR	SETUP-INFO
BIRA-DCMNT-TYPE-CD	KEEP-FLAG	SETUP-INFO-2
BIRA-EFFECTV-YYYYMM-DT	KEYS	SFIN-FI
BOND-PGM-TYPE-ID	KIND-OF-PROJECT	SOURCE-COST-CTR
BUDGET-ACCOUNT	LAPA-CODE	SOURCE-DIST-DIV
BUDGET-ACTIVITY	LAST-UPDT-DT	SOURCE-UNIT
BUDGET-DIST	LAST-UPDT-TM	STATUS
CE-PCT	LAST-UPDT-USER-ID	STATUS-CHANGE-DATE-DT
CONTRACT-NO	LOW-BID-AMOUNT	STATUS-CHANGE-DATE-YYMM
COST-CENTER-INFO	LTD-ADMIN-AMT	SUPERZA
COST-CTR	LTD-ADMIN-AMT2	SUPERZB
COUNTY-NUMBER	LTD-AMOUNT	SUPERZC
CSJ	LTD-MANHRS	SUPERZD
DCIS-INFO	LTD-RETAINAGE-AMOUNT	SUPERZE
DELETE-FLAG	MANAGER-NO	SUPERZF
DH-FILLER-FIELD	MAN-HOURS	SUPERZG
DIST-DIV	MASTER-UPDATE-FLAG	SUPERZH
EFFECTIVE-DATE-DT	MTD-AMOUNT	SUPERZI
EFFECTIVE-DATE-YYMM	MTD-ARRAYS	SUPERZJ
FI-FILLER-FIELD	MTD-MANHRS	SUPERZK
FINAL-BILLING-CODE	NEW-FUND-SOURCE	SUPERZP
FUNCTION	OBJECT-EXP	SUPERZQ
FUNCTION-RANGE	OBLIGATION-AMOUNT	TASK-NO
FUNDING-INFO	OBSOLETE-IND	TRANS-ID
FUND-PCT	POSTING-AMOUNT	TRUST-FUND-IND
FUND-SOURCE	POSTING-DATE	TYPE-NEW
GL-FISCAL-YR	POSTING-DATE-DT	TYPE-OLD
GL-FISCAL-YR-DT	POSTING-INFO	TYPE-WORK
GL-INFO	PREV-FY-INFO	VOUCH-KIND
GL-LEDGER-NO	PRIMARY-CSJ	VOUCH-NO
GL-STATE-FUND	PRIOR-YTD-AMOUNT	YTD-AMOUNT
GL-TRANS20-AMOUNT	PRIOR-YTD-MANHRS	YTD-AMT-PREV1-FY
GL-TRANS24-AMOUNT	PRIOR-YTD-OBLIGATION	YTD-AMT-PREV2-FY

Table 17. FIMS Segment 78 (FIMS-RMT78) Data Fields (25).

Field	Field	Field
ACTUAL-CLASS	GL-LEDGER-NO	POSTING-DATE
AMOUNT-TIME-INFO	GL-STATE-FUND	POSTING-DATE-DT
AUTHORITY-DESCR	GL-TRANS20-AMOUNT	POSTING-INFO
BKEND-GEN-FY1	GL-TRANS24-AMOUNT	PREV-FY-INFO
BKEND-GEN-FY2	HWY-CNTY-DDO-FUNC-KEY	PRIOR-YTD-AMOUNT
BOUCH-NO	HWY-DESCR	PRIOR-YTD-MANHRS
BUDGET-ACCOUNT	HWY-INFO	RECORD-KEYS
BUDGET-ACTIVITY	HWY-MAP-INFO	SETUP-INFO
BUDGET-DIST	HWY-MILEAGE	SOURCE-COST-CTR
COST-CTR	HWY-SETUP-INFO	SOURCE-DIST-DIV
COST-CTR-INFO	ID-FILLER-FIELD	SOURCE-UNIT
COUNTY	INDICATOR-INFO	STATUS
DELETE-FLAG	INVOICE-DESCR	SUPER-ZA
DIST-DIV	KEEP-FLAG	SUPER-ZB
EFFECTIVE-DATE-DT	LAST-UPDT-DT	SUPER-ZC
EFFECTIVE-DATE-YYMM	LAST-UPDT-TM	SUPER-ZE
EI-FILLER-FIELD	LAST-UPDT-USER-ID	SUPER-ZF
ENABLE-IND	MAINT-SECTION	SUPER-ZG
FISCAL-YR	MAN-HOURS	SUPER-ZH
FUNCTION	MASTER-UPDATE-FLAG	TASK-NO
FUNCTION-RANGE	MTD-AMOUNT	TRANS-ID
FUNDING-INFO	MTD-ARRAYS	VOUCH-KIND
FUND-PCT	MTD-MANHRS	VOUCH-NO
FUND-SOURCE	NEW-FUND-SOURCE	YTD-AMOUNT
GL-FISCAL-YR	OBJECT-EXP	YTD-AMT-PREV1-FY
GL-FISCAL-YR-DT	OBSOLETE-IND	YTD-AMT-PREV2-FY
GL-INFO	POSTING-AMOUNT	YTD-MANHRS

TEXAS PERMIT ROUTING OPTIMIZATION SYSTEM

TxPROS is a web-based application that TxDOT is developing to improve oversize/overweight (OS/OW) routing and permitting tasks (26, 27). TxPROS will replace the existing Central Permitting System (CPS), using a TxDOT customization of the ProMiles web-based permitting system (28).

The TxPROS application stores data in an Oracle database. Using integrated GIS mapping and real-time restriction management, TxPROS will provide automated routing and route validation assistance (27). Major TxPROS features include the following (26):

- **Mapping.** TxPROS uses Tele-Atlas®' street network, which covers the entire state, conflated with TxDOT roadway inventory data.
- **Restrictions management.** TxPROS supports web-based updates to permanent (e.g., height, width, weight, maneuvering), temporary (e.g., construction), and directive (e.g., flagmen needed to traverse a certain bridge) restrictions affecting OS/OW routing.
- **Routing.** TxPROS generates routes using restriction management and route points. A key TxPROS functionality will be the capability to generate and evaluate alternate OS/OW routes.
- **Reporting.** TxPROS supports report templates and ad hoc queries, such as “how many X ton loads have traversed this segment.”

PERMANENT STRUCTURE NUMBER

PSN is an intranet-based application that accepts requests from districts for new permanent bridge structure numbers (18). PSN data reside in an Oracle schema. The TxDOT Bridge Division manages PSN data content to ensure that a structure has only one PSN value, while TSD maintains the PSN application and database. PSN values are unique and are an essential component of a structure ID. A structure ID uniquely identifies a structure within the NBI database. In Texas, structure IDs are concatenations of PSN values with control sections and county codes. By knowing the structure ID, TxDOT staff can retrieve data and the status of a structure within BRINSAP.

Depending on user permissions, the PSN application allows users to retrieve, request, and assign on-system PSN values. To request a PSN value, users enter the following information (29, 30):

- CSJ number,
- backlogged flag,
- letting date,
- county,
- replaced structure ID,
- type of service under/on the bridge,
- structure function of roadway under/on the bridge,
- control section of roadway under/on the bridge,
- type of roadway under/on the bridge,
- number of roadway under/on the bridge
- additional name/description of what is under/on the bridge,
- route direction,
- beginning station number,
- ending station number, and
- comments.

PSN is intended for use during the project development process. When districts log in a new structure number request, the system checks the replicated DCIS data warehouse in SQL Server to determine if the project is within one year of letting. If the project is within one year of letting, the PSN application assigns a PSN value to the specific structure.

Users can also search for PSN values, replaced PSN values, rejected PSN values, and CSJ values and can export the results to a text file or a Microsoft Excel file (29, 30). The PSN search results include structure number, facility carried, facility crossed, CSJ, and job status. Users can also view memorandums documenting the assignment of specific PSN values.

BRIDGE SHOP PLAN

TxDOT is developing a web-based application called Bridge Shop Plan that records and tracks data about shop plans that fabricators and contractors submit to TxDOT electronically. This application, which uses a SQL Server platform, is currently in development by TSD.

In several states, asset management information systems, such as bridge management, have suffered from data and communication disconnects from design and construction systems. These disconnects occur after bridges are opened to traffic but bridge inspectors are not notified. Linking the Bridge Shop Plan application to a BMIS could reduce this disconnect, in that bridge inspectors would be notified when shop plans for a bridge have been submitted to TxDOT, when the plans are available for use by the inspectors after bridge construction, and if the schedule for an anticipated bridge inspection needs to be updated.

GIS-BASED PRACTICES, PLANS, AND APPLICATIONS

TxDOT primarily uses GIS technology to support programming, planning, and maintenance activities—although the use of GIS to support design, construction, and operations is growing. TxDOT GIS production data reside on an Oracle database. Table 18 provides a summary of production GIS datasets at TxDOT, with an indication of the source (TxDOT or other agency). TxDOT GIS data must conform to TxDOT GIS Standards (31) and the TxDOT Data Architecture (32).

Table 18. Production GIS Datasets at TxDOT (33).

GIS Data Subject	Number of GIS Feature Classes According to Data Source	
	TxDOT	Other Agencies
Air		2
Aviation	2	6
Facility	1	
Geopolitical	8	5
Land	1	13
Public Land	3	4
Railroad	1	
Structures	3	
TxDOT Route	14	
Water	3	17

The Structures production datasets include the following (33):

- **BRINSAP_MST_PNT.** This dataset contains points that represent the location of bridges and structures. The dataset includes structures that are on the TxDOT route system (on system) and that are not on the TxDOT route system (off system). This dataset was created to be used in MST intranet application (33). These data are extracted from the BRINSAP mainframe VSAM file and contain 233 fields. No changes to data names have been made to comply with TxDOT data naming conventions. The Bridge Division data steward felt that changing the system of record data names would create confusion.
- **BRINSAP_PNT.** This dataset also contains points that represent the location of on- and off-system bridges or structures. These data are extracted from the BRINSAP mainframe VSAM file and contain a subset of five out of 233 fields.

- **LRBM.** This dataset is a set of points that identify the location of structures that have safety load restrictions, are closed, or are land locked. The dataset includes on- and off-system structures. These data are extracted from the BRNSAP mainframe VSAM file and contain a subset of 21 out of 233 fields.

SYSTEM DIAGRAM AND RELATIONSHIPS

Figure 4 shows high-level relationships between several bridge-related systems described in this chapter. For completeness, this figure shows existing, potential, and research project prototype linkages. Systems not depicted in Figure 4 include FIMS, TxPROS, and Bridge Shop Plan. FIMS reprocesses bridge related data, TxPROS is a consumer of bridge related data, while Bridge Shop Plan is in development. In general, DCIS, BRINSAP, Pontis, PonTex, and BridgeLog provide core data for bridge infrastructure management. Other systems, notably, MMIS, MST, and FIMS, provide supplemental or supporting data for bridge infrastructure management.

Figure 4 uses the TxDOT's system interface diagram (TSID) notation found in the TxDOT Data Architecture document (32). The header of Figure 4 provides system data sources the researchers used to develop this figure. In Figure 4, system applications, including programs, functions, tools, interfaces, front ends, and other similar elements are represented by rectangles; user access is represented by workstations; and database file storage is represented by cylinders. Database files are grouped together based on database system or architecture. For example, DCIS and MMIS use the Adabas environment. Data for Pontex, Main Street Texas and BridgeLog are stored in Oracle, while replicated Adabas data are stored in SQL Server.

In Figure 4, existing linkages are shown by solid lines, future linkages are shown by dashed lines, and linkages for the research prototypes are shown by dotted lines. In general, TxDOT staff runs programs and functions from workstations that populate, query, and retrieve data from databases. Some programs are accessible internally through TxDOT's Crossroads intranet (e.g., MST) or externally with the assistance of a Citrix gateway (e.g., PonTex). Data warehouses (e.g., COMMON_DSGN, ArcSDE STRUCTURES) are populated and updated from legacy systems (e.g., DCIS, BRINSAP). Currently, PonTex populates a modified-Pontis schema that updates BRINSAP data records. In the future, it is expected that TxDOT will be using the latest version of Pontis and will populate a Pontis schema.

The 0-6389 prototype applications, described in Chapters 3 through 5, plus Appendices A and B, access DCIS tables located in the COMMON_DSGN schema in SQL Server. This access is done by using ODBC with Microsoft Access or by using Microsoft SQL Server Management Studio, both through TxDOT's web-based Citrix gateway connection.

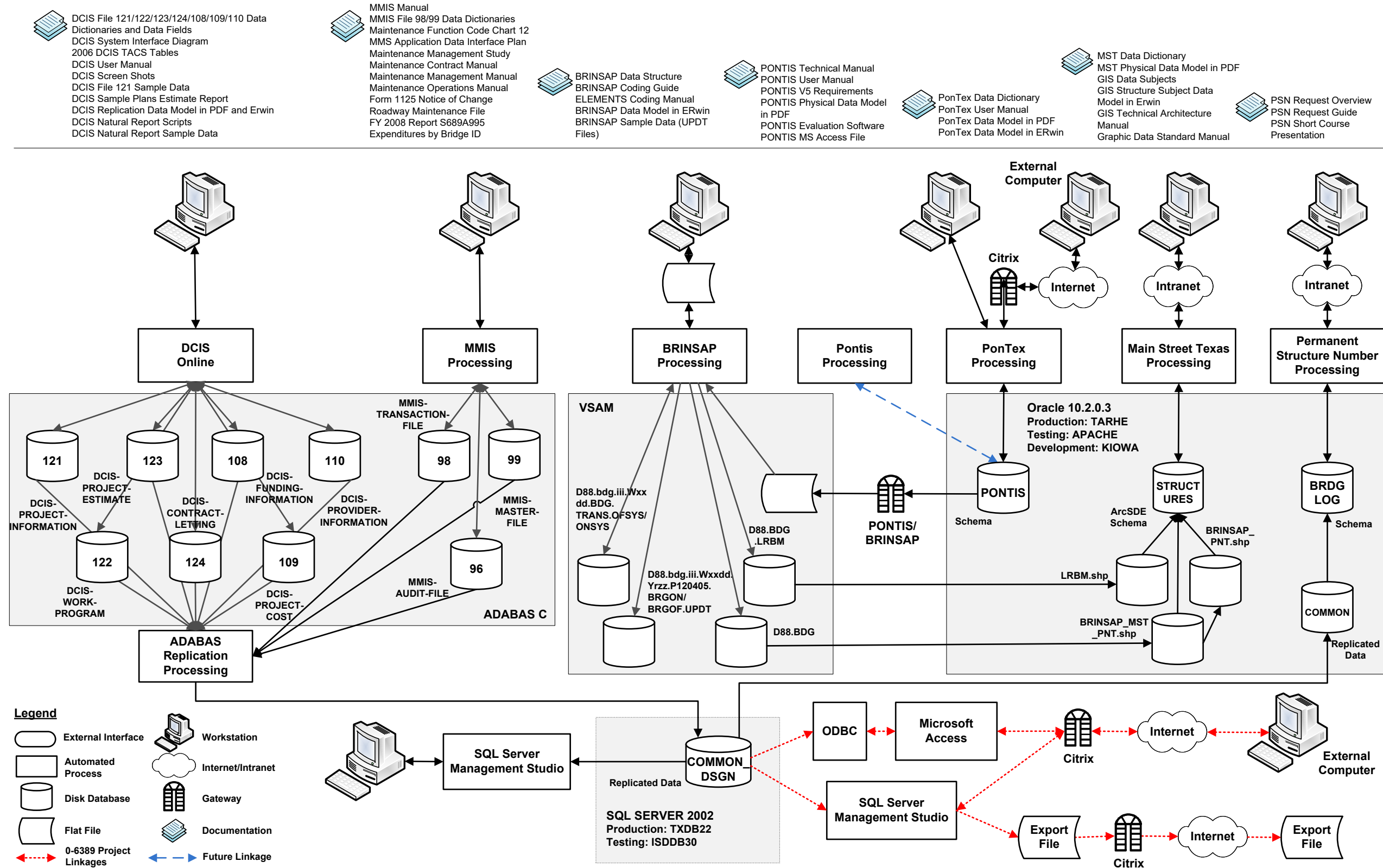


Figure 4. Bridge-Related Systems at TxDOT.

CHAPTER 3. PROTOTYPE DATABASE APPLICATION TO EXTRACT SUMMARY BRIDGE STATISTICS

INTRODUCTION

This chapter describes the development of the prototype database application to extract summary bridge statistics needed for the annual bridge report and other similar queries. It includes a discussion about data reporting and other requirements that guided the development effort and a description of the process to build the prototype database application. Chapter 5 includes the corresponding installation and user guide. Appendix A includes details on the queries to produce the prototype bridge report tables.

REQUIREMENTS FOR THE SUMMARY BRIDGE STATISTICS PROTOTYPE

The overall objective of the prototype database application was to replicate statistics published in the *Report on Texas Bridges* (34). This report describes the condition of all publicly-owned vehicular bridges in Texas at the end of each fiscal year and helps TxDOT track progress toward the goals established by the Texas Transportation Commission to make 80 percent of bridges in Texas in good or better condition and eliminate structurally deficient on-system bridges (35). Table 19 lists the tables and figures included in the 2008 *Report on Texas Bridges*. The researchers replicated all the tables and figures in the report, with the exception of the following:

- **Table 3-3 Land-Locking Bridges as of September 2008.** This table requires the use of information that is not available in DCIS or BRINSAP, e.g., a visual examination of TxDOT highway maps to determine whether a bridge is a land-locking bridge.
- **Table 6-5 PWP/EMP Projects in FY 2008 by District.** This table is based on data from a separate TxDOT Bridge Division annual report (36) that tracks participation-waived projects (PWPs) and equivalent-match projects (EMPs).
- **Figure A-1 Map of Texas Counties with TxDOT Districts.** This figure does not use bridge data.

Table 19. Tables and Figures in the 2008 *Report on Texas Bridges*.

Page	Table/ Figure	Caption	Note
Chapter 2 - Characteristics of Texas Bridges			
11	Figure 2-1	Count of On- and Off-System Texas Bridges as of September 2008 (50,572 Total)	Based on Table 2-1
12	Table 2-1	Count of On- and Off-System Bridges	-
13	Table 2-2	Age of Bridges in FY 2008	-
13	Figure 2-2	Age of On- and Off-System Texas Bridges in FY 2008 (50,572 Total)	Based on Table 2-2
14	Table 2-3	Change in Age of Bridges from September 2006 to September 2008	-
14	Figure 2-3	On-System Timber Bridges by Year	-
Chapter 3 - Condition of Texas Bridges			
16	Table 3-1	Condition of Texas Bridges by Count in September 2008 (50,572 Total)	-
16	Figure 3-1	Condition of Texas Bridges by Count in September 2008 (50,572 Total)	Based on Table 3-1
18	Figure 3-2	Change in Condition of Non-Sufficient Bridges from FY 2006–2008	-
19	Table 3-2	Load Posted and Closed Bridges as of September 2008	-
20	Table 3-3	Land-Locking Bridges as of September 2008	Not replicated
Chapter 5 - On-System Contract Awards			
27	Table 5-1	On-System Bridges Awarded in Highway Bridge Program (HBP) Projects, by District	-
27	Table 5-2	On-System Bridges Awarded in Non-HBP Projects, by District	-
28	Table 5-3	On-System Bridges Replaced or Rehabilitated in FY 2008	-
28	Table 5-4	On-System Bridges in Bridge Projects Awarded in FY 2008	-
29	Figure 5-1	Distribution of Funds Spent on On-System Bridges in FY 2008	Based on Table 5-4
Chapter 6 - Off-System Contract Awards			
31	Table 6-1	Off-System Bridges Awarded in HBP Projects, by District	-
31	Table 6-2	Off-System Bridges Awarded in Non-HBP Projects, by District	-
32	Table 6-3	Off-System Bridges Replaced or Rehabilitated in FY 2008	-
32	Table 6-4	Off-System Bridges in Bridge Projects Awarded in FY 2008	-
33	Figure 6-1	Distribution of Funds Spent on Off-System Bridges in FY 2008	Based on Table 6-4
34	Table 6-5	PWP/EMP Projects in FY 2008 by District	Not replicated
Chapter 7 - Meeting the Challenges			
36	Table 7-1	Bridges that Must Be Improved to Reach the 80%-Sufficient-by-End-of-2011 Goal	-
Appendices A - C			
39	Figure A	Map of Texas Counties with TxDOT Districts	Not replicated
41	Table B	Condition of On-System Bridges by TxDOT District and County as of September, 2008	-
49	Table C	Condition of Off-System Bridges by TxDOT District and County as of September, 2008	-

Specific requirements for the development of the prototype included the following:

- replicate as many 2008 *Report on Texas Bridges* tables and figures as possible,
- use a standalone database environment (more specifically Microsoft Access 2003),
- use generic query structures for the prototype to use any combination of years of interest,
- use snapshot views of BRINSAP representing end-of-year bridge inventory conditions, and
- use snapshot views of DCIS representing end-of-year project funding conditions.

The researchers received copies of the BRINSAP database from the Bridge Division representing “end-of-year” conditions for fiscal years 2001–2008. The researchers also received a partial BRINSAP database for fiscal year 2009. Each database file (in Microsoft Access 2003 format) includes two tables, BRGOF and BRGON, which represent off-system and on-system bridges, respectively. The Bridge Division extracts end-of-year inspection files from BRINSAP files on the mainframe to develop the annual bridge report. The practice of extracting end-of-year files is necessary because the mainframe does not store historical data.

The researchers also received partial DCIS tables that facilitated the development of preliminary queries. However, TxDOT did not have reliable copies of snapshot DCIS views to replicate the annual bridge report. As described in Chapter 2, TxDOT has replicated all DCIS files into the SQL Server COMMON_DSGN schema. The researchers received live read-only access to select table views through a web-based Citrix gateway. “Live” data are not the same as end-of-year data since some DCIS data may have changed after the end of the fiscal year. Although differences between query results and the published report were found, the researchers felt these differences were minor.

The web-based Citrix gateway (Figure 5) is a mechanism TxDOT uses to provide consultants and contractors restricted access to its non-legacy systems and databases. After a user has successfully entered a user name and password, an icon for the RA CITRIX2 Citrix Desktop application is presented (Figure 6). Clicking on the icon launches the Citrix Desktop environment, where users can access DCIS data in the COMMON_DSGN schema using SQL Server Enterprise Manager (Figure 7) or using Microsoft Access through an ODBC driver (Figure 8).

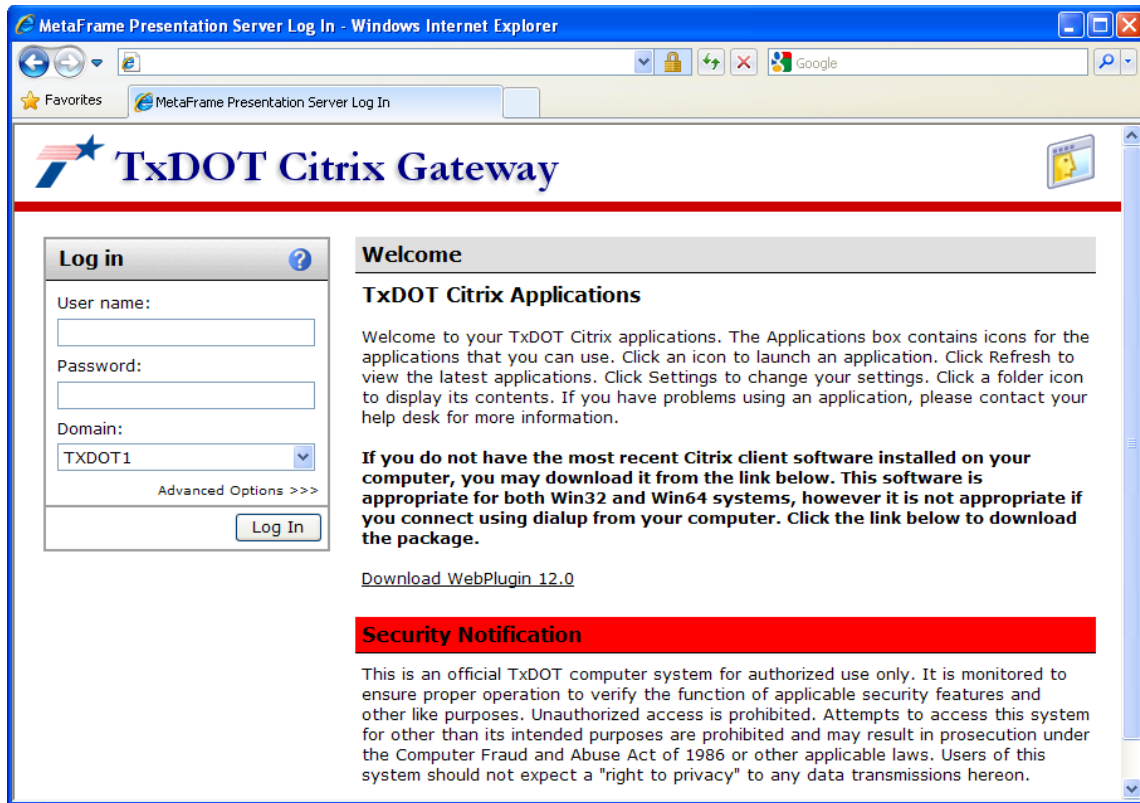


Figure 5. TxDOT Citrix Gateway Login Screen.



Figure 6. TxDOT Citrix Gateway Applications Screen.

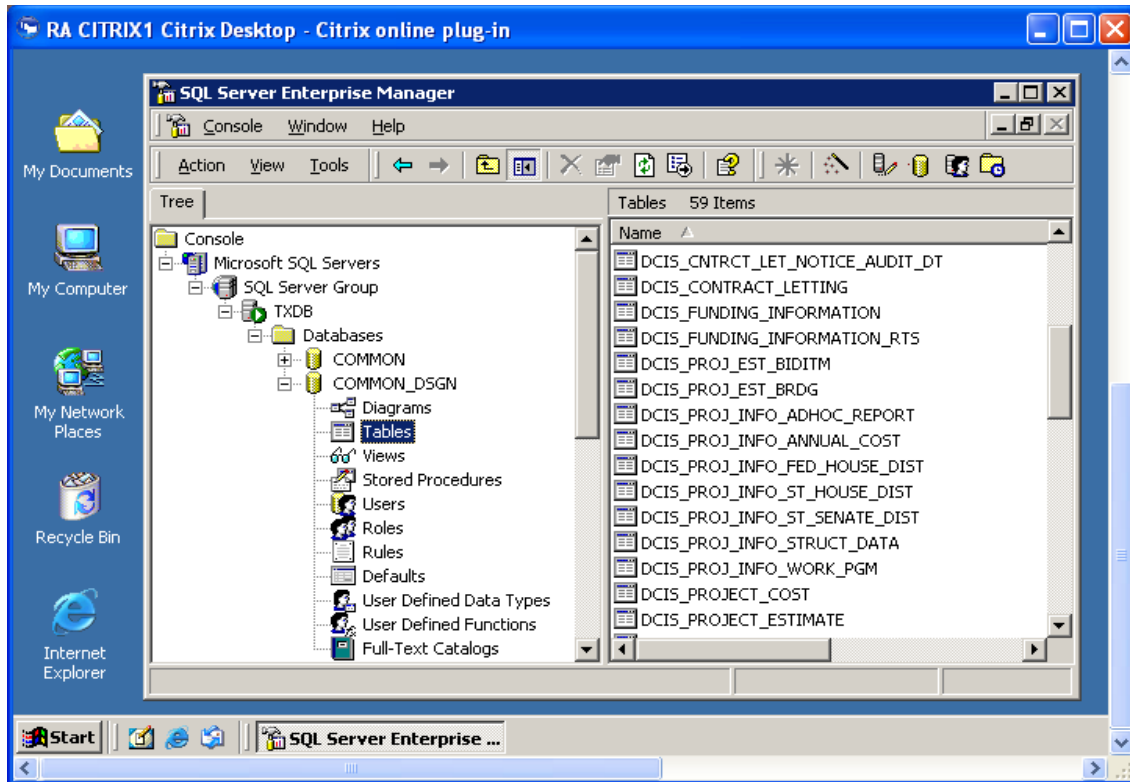


Figure 7. RA CITRIX2 Citrix Desktop with SQL Server Enterprise Manager.

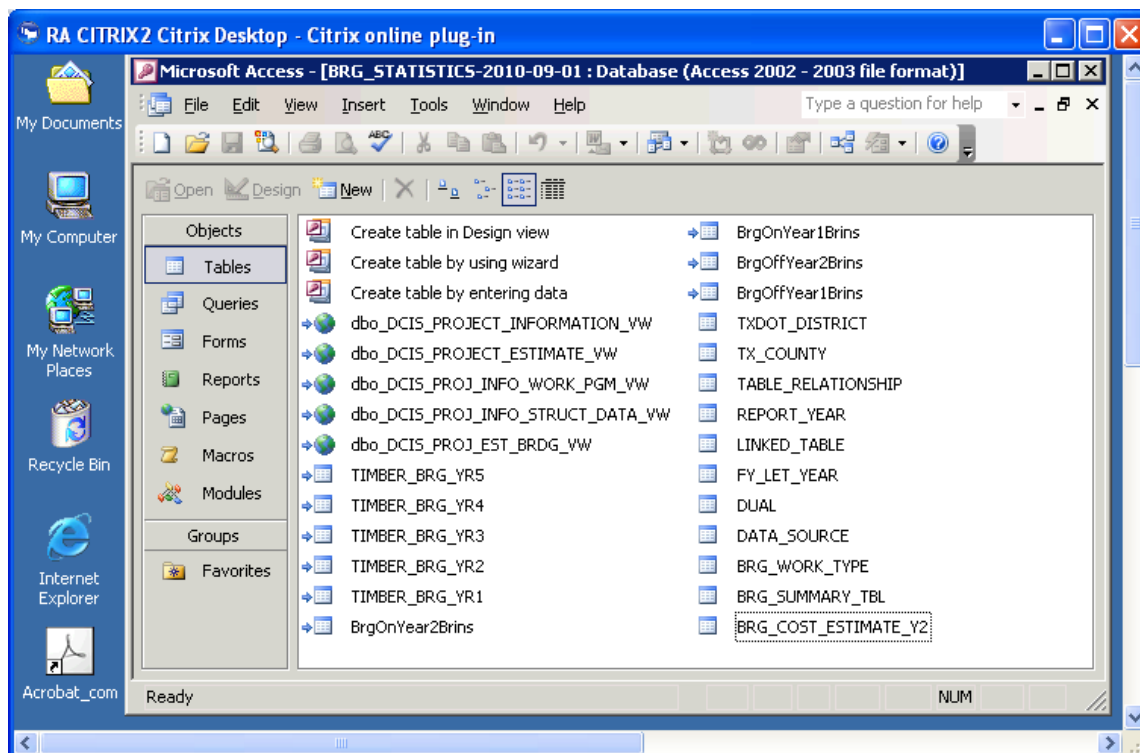


Figure 8. Citrix Desktop with Microsoft Access Summary Bridge Statistics Prototype.

DEVELOPMENT OF BRIDGE STATISTICS PROTOTYPE APPLICATION

Development of the prototype database application involved the following major steps:

- Identify data elements for each table or figure in the 2008 *Report on Texas Bridges*,
- Create queries that replicate the tables and figures in this report, and
- Develop a form-based database application interface.

The following are detailed descriptions of the issues and challenges during these steps.

Identifying Data Elements

TxDOT publishes the *Report on Texas Bridges* annually based on data primarily from BRINSAP and DCIS. For each table or figure in the 2008 report, the research team first identified the data sources (i.e., BRINSAP and/or DCIS) and then identified the data elements with TxDOT assistance. The level of TxDOT assistance with data element identification varied based on the data sources and complexity of the data fields contained in a report table. In general, as part of the data element identification, the researchers categorized tables from the Report on Texas Bridges into the following:

- **Report tables and figures based on one end-of-year BRINSAP database.** These tables and figures use data either from a single table (e.g., Appendix B – Condition of On-System Bridges by TxDOT District and County as of September 2008) or from multiple tables (e.g., Table 2-2 Age of Bridges in FY 2008) from a single end-of-year BRINSAP database. For this category, the research team identified the data source (i.e., BRINSAP) and data elements with minimum TxDOT assistance.
- **Report tables and figures based on multiple BRINSAP databases or subject matter expertise.** Some report tables or figures use data from multiple tables in multiple BRINSAP databases (e.g., Table 2-3 Change in Age of Bridges from September 2006 to September 2008). Some involve calculations that are difficult to understand without first-hand knowledge (e.g., Table 7-1 Bridges that Must Be Improved to Reach the 80%-Sufficient-by-End-of-2011 Goal). For this category, the researchers had to use TxDOT assistance to identify all data elements or clarify the calculation procedures.
- **Report tables and figures based on DCIS data.** A number of report tables involve DCIS data (e.g., Table 5-4 On-System Bridges in Bridge Projects Awarded in FY 2008). DCIS is relatively complex and contains a large number of data files and data fields. DCIS has new, obsolete, or modified attributes, which can cause confusion during the data identification process. For many of these tables, the research team had to rely on TxDOT assistance in order to identify correct data elements.
- **Report tables and figures involving data not available in existing data sources.** Some report tables (i.e., Table 3-3 Land-Locking Bridges as of September 2008 and Table 6-5 PWP/EMP Projects in FY 2008 by District) require information that is not

readily available in TxDOT data systems. The research team spent significant resources on data identification for these tables but discovered that the necessary data were not in the available data sources. Upon approval from TxDOT, these tables were not included in the developed prototype.

Table 20 lists the data sources and data elements identified for each of the replicated tables and figures in the 2008 *Report on Texas Bridges*. For report tables with BRINSAP as a data source, Table 20 includes how many years of data are needed and what roadway systems are used (i.e., on- and/or off-system). Additionally, in this table, data elements from DCIS table views and DCIS-generated tables are bulleted.

Table 20. Major Data Elements for Bridge Statistics Prototype.

Table/Figure	Data Source	Data Elements
Table 2-1	BRINSAP (two years, on- and off- system)	Bridge Structure ID Item 5.1 – Structure Function Item 22 – Owner
Table 2-2	BRINSAP (one year, on- and off- system)	Bridge Structure ID Item 5.1 – Structure Function Item 22 – Owner Item 27 – Year Built
Table 2-3	BRINSAP (two years, on- and off- system)	Same as Table 2-2
Figure 2-3	BRINSAP (five years, on-system)	Bridge Structure ID Item 5.1 – Structure Function Item 22 – Owner Item 44.1 – Substructure Type, Main Spans Item 44.2 – Substructure Type, Major Approach Spans Item 44.3 – Substructure Type, Minor Approach Spans
Table 3-1	BRINSAP (one year, on- and off- system)	Bridge Structure ID Item 5.1 – Structure Function Item 22 – Owner Item 41 – Structure Open, Posted, or Closed to Traffic Item 120 – Deficient/Obsolete Code
Figure 3-2	BRINSAP (two years, on- and off- system)	Same as Table 3-1
Table 3-2	BRINSAP (one year, on- and off- system)	Bridge Structure ID Item 5.1 – Structure Function Item 22 – Owner Item 41 – Structure Open, Posted, or Closed to Traffic
	Table Accounting Code System (TACS)	TxDOT District name and number
Table 5-1	DCIS	DCIS_PROJ_EST_BRDG_VW • BRDG_NBI_NUMBER • BRDG_SYSTEM_ID DCIS_PROJECT_INFORMATION_VW • DISTRICT_NUMBER • ACTUAL_LET_DATE DCIS_PROJ_INFO_WORK_PGM_VW • CATEGORY_P2
Table 5-2	DCIS	Same as Table 5-1

Table 20. Major Data Elements for Bridge Statistics Prototype (continued).

Table/Figure	Data Source	Data Elements
Table 5-3	BRINSAP	Bridge Structure ID Item 27 – Year Built Item 120 – Deficient/Obsolete Code Operation Status
	DCIS	DCIS_PROJ_EST_BRDG_VW • BRDG_NBI_NUMBER • BRDG_SYSTEM_ID • BRDG_WORK_TYPE DCIS_PROJECT_INFORMATION_VW • ACTUAL_LET_DATE DCIS_PROJ_INFO_WORK_PGM_VW • CATEGORY_P2 DCIS_PROJ_INFO_STRUC_DATA • NBI_NUMBER
Table 5-4	DCIS	DCIS_PROJ_EST_BRDG_VW • BRDG_NBI_NUMBER • BRDG_SYSTEM_ID • BRDG_WORK_TYPE DCIS_PROJECT_INFORMATION_VW • ACTUAL_LET_DATE DCIS_PROJ_INFO_WORK_PGM_VW • CATEGORY_P2 • PROJ_COST BRG_COST_ESTIMATE_Y2 (table generated by the Bridge Cost Estimate prototype, see Total Bridge Cost Estimate section of Appendix B) • Contract CSJ • Project Winning Bid • Winning Bid for Bridge Project
Table 6-1	DCIS	Same as Table 5-1
Table 6-2	DCIS	Same as Table 5-1
Table 6-3	BRINSAP	Same as Table 5-3
	DCIS	
Table 6-4	DCIS	Same as Table 5-4
Table 7-1	BRINSAP (one year, on- and off- system)	Same as Table 3-1
Table B	BRINSAP (one year, on-system)	Bridge Structure ID Item 5.1 – Structure Function Item 22 – Owner Item 41 – Structure Open, Posted, or Closed to Traffic Item 120 – Deficient/Obsolete Code
	TACS	TxDOT District name and number County name and TxDOT number
Table C	BRINSAP (one year, off-system)	Same as Table B
	TACS	

Creating Summary Bridge Statistics Prototype Queries

Query creation verified the identification of data elements. The researchers started creating most queries at the same time their data elements were being identified. Creating the queries that only involve BRINSAP data were straight forward. Queries involving DCIS data were more difficult to replicate and frequently required a time-consuming trial-and-error process. The major challenges during the process included:

- There was a selection of data elements that could be used for a data field in a query. This challenge was common for some complicated queries involving DCIS data due to the following factors:
 - The same data field is included in multiple tables. Without sufficient documentation, it is difficult to know which data field and corresponding table contains the original field and if all fields are updated regularly. It is critical that the application uses the original field that is regularly updated.
 - Certain data fields in DCIS became obsolete over time and were replaced by new fields. In this case, the challenge was to identify if the data contained by the old field were transferred to the new replacement field. Many queries require access to the complete data in order to produce accurate results.
- Some queries with DCIS data produced significantly different results compared to the 2008 report. Reasons for this issue included one or more of the following:
 - TTI used live DCIS data instead of end-of-year DCIS data, which was used in the 2008 report. The live data contained updates made after the end of the fiscal year that were not reflected in the 2008 report.
 - The replicated queries were not correct due to indiscernible errors associated with the identified data elements or calculation procedures.
 - The 2008 report included problematic tables associated with bridge costs. Numerous discrepancies in DCIS data were resolved through a manual process by BRG. Thus, certain tables in the report could contain problematic results that were not replicable.
- A few replicated queries produced slightly different results compared to the 2008 report. These queries had correct structures and data elements as verified by relevant TxDOT BRG officials. The differences could be due to discrepancies between the BRINSAP and DCIS data that the research team used and the data TxDOT originally used for the 2008 report. Nevertheless, these queries were considered correct as the differences were insignificant.

To address these challenges, the research team routinely met with BRG and/or TSD to verify the data elements and calculation procedures used in the queries. As a result, the research team was

able to resolve all the challenges and successfully replicated all necessary queries in the final prototype application.

Developing Summary Bridge Statistics Prototype Interface

In conjunction with query creation for the prototype, the researchers developed a graphical user interface (GUI) to assist users in the production of summary bridge statistic reports. The application was developed in Microsoft Access 2003 and used the Access Form function for development of the user interface. The major objectives of the interface were:

- to provide basic user guidance for the application,
- to facilitate users in selecting necessary data files, and
- to provide user-friendly access to all queries.

The major considerations during the interface development included:

- **Interface design.** To meet the major objectives of the prototype user interface, the researchers decided to use a multi-tab interface that includes the following five tabs:
 - Introduction, which provides brief background information on the application.
 - BRINSAP Data Sources, which allows users to specify the BRINSAP data files for creating the annual bridge report.
 - DCIS Data Sources, which allows users to specify the years for which DCIS data will be used.
 - Timber Bridge Data Sources, which allows users to specify the data files for the timber bridge analysis.
 - Bridge Statistics, which allows users to generate the desired tables or figures from the annual *Report on Texas Bridges*.
- **BRINSAP data linkage.** In the annual *Report on Texas Bridges*, many of the tables require two years of BRINSAP data for comparison; however, the timber bridge analysis requires data for five years. For simplicity and flexibility, the researchers decided to provide separate tabs for selecting the end-of-year BRINSAP database files: one tab for selecting the two BRINSAP database files that are needed for most tables and the other tab for selecting the five BRINSAP database files for the timber bridge analysis. The application passes the specified years to corresponding queries that in turn would select the desired BRINSAP data
- **DCIS data linkage.** The prototype application has a direct linkage to live DCIS data. For simplicity and flexibility, the research team decided to create a separate tab for users to specify the two DCIS data years needed for the queries. The application passes the specified years to corresponding queries that in turn would select the desired DCIS data.

DEVELOPED SUMMARY BRIDGE STATISTICS PROTOTYPE APPLICATION

The Summary Bridge Statistics prototype application is a Microsoft Access 2003 database application consisting of tables (Figure 9 and Table 21), queries (Figure 10 and Table 22), and a form-based interface. The prototype includes several queries that are invoked through the application's form interface. These queries, called "main queries" invoke other queries, called "sub-queries." Table 22 lists the main queries and sub-queries used to produce each report table or figure in the prototype. Appendix A describes these main queries and the sub-queries associated with them. The installation guide and user guide in Chapter 5 of this report includes detailed illustrations of the application's interface, structure, and functions.

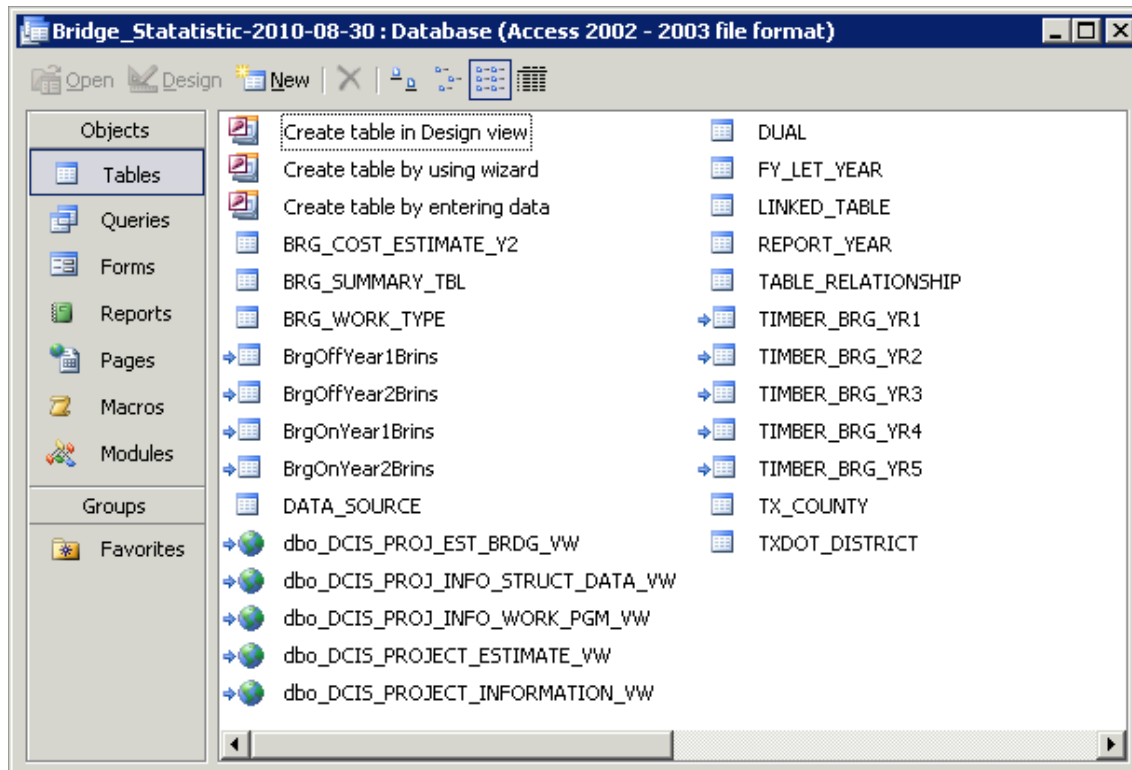


Figure 9. Tables in the Summary Bridge Statistics Prototype.

Table 21. Tables in the Summary Bridge Statistics Prototype.

Name	Table Type	Description
BRG_COST_ESTIMATE_Y2	Native	Contains bridge project cost data. This table is produced by the Bridge Cost Estimate Prototype Application.
BRG_SUMMARY_TBL	Native	Contains a list of main queries and descriptions of the tables/figures they produce.
BRG_WORK_TYPE	Native	Contains bridge work type names and codes from Bridge Cost Information (BCI) and P3B screens of DCIS.
BrgOffYear1Brins	Linked Access Table	Contains BRINSAP data of off-system bridges for a year prior to the report year for comparison purpose. For example, to create Table 2-3 “Change in Age of Bridges from September 2006 to September 2008 in the 2008 report,” this would be the BRGOF table in the fiscal year 2006 end-of-year BRINSAP snapshot database file.
BrgOffYear2Brins	Linked Access Table	Contains BRINSAP data of off-system bridges for the report year. For example, to create the 2008 report, this would be the BRGOF table in the fiscal year 2008 end-of-year BRINSAP snapshot database file.
BrgOnYear1Brins	Linked Access Table	Contains BRINSAP data of on-system bridges for the year prior to the report year. For example, to create Table 2-3 Change in Age of Bridges from September 2006 to September 2008 in the 2008 report, this would be the BRGON table in the fiscal year 2006 end-of-year BRINSAP snapshot database file.
BrgOnYear2Brins	Linked Access Table	Contains BRINSAP data of on-system bridges for the report year. For example, to create the 2008 report, this would be the BRGON table in the fiscal year 2008 end-of-year BRINSAP snapshot database file.
DATA_SOURCE	Native	Stores the data sources of the linked BRINSAP data tables for use by the Form-based interface.
dbo_DCIS_PROJ_EST_BRDG_VW	Linked SQL Table	This is the linked DCIS_PROJ_EST_BRDG_VW view from the TxDOT SQL Server database.
dbo_DCIS_PROJ_INFO_STRUCT_DATA_VW	Linked SQL Table	This is the linked DCIS_PROJ_INFO_STRUCT_DATA_VW from the TxDOT SQL Server database.
dbo_DCIS_PROJ_INFO_WORK_PGM_VW	Linked SQL Table	This is the linked DCIS_PROJ_INFO_WORK_PGM_VW from the TxDOT SQL Server database.
dbo_DCIS_PROJECT_ESTIMATE_VW	Linked SQL Table	This is the linked DCIS_PROJECT_ESTIMATE_VW view from the TxDOT SQL Server database.
dbo_DCIS_PROJECT_INFORMATION_VW	Linked SQL Table	This is the linked DCIS_PROJECT_INFORMATION_VW view from the TxDOT SQL Server database.
DUAL	Native	Empty table used by some queries (e.g., _Table_2_3_Bridge_Age_Change) to meet SQL syntax requirements when no data need to be extracted.
FY_LET_YEAR	Native	Stores a list of years from 1993–2011 for use by the Form-based interface.
HBP_PROJECT	Native	
LINKED_TABLE	Native	Stores the names of linked BRINSAP tables for use by the Form-based interface.
REPORT_YEAR	Native	Contains two records (i.e., 2006 and 2008) that are the two years used frequently on the 2008 bridge report for use by the Form-based interface.
TABLE_RELATIONSHIP	Native	Contains a list of relationships between certain queries for use by the Form-based interface. This table enables the application to identify and overwrite the fiscal years used in the listed queries according to user selections on interface.

Table 21. Tables in the Summary Bridge Statistics Prototype (Continued).

Name	Table Type	Description
TIMBER_BRG_YR1	Linked Access Table	Contains BRINSAP data of on-system bridges for the first fiscal year in the timber bridge analysis similar to Figure 2-3 On-System Timber Bridges by Year in the 2008 report. For example, for the 2008 report, this would be the BRGON table in the fiscal year 2002 end-of-year BRINSAP snapshot database file.
TIMBER_BRG_YR2	Linked Access Table	Contains BRINSAP data of on-system bridges for the second fiscal year in the timber bridge analysis. For example, for the 2008 report, this would be the BRGON table in the fiscal year 2003 end-of-year BRINSAP snapshot database file.
TIMBER_BRG_YR3	Linked Access Table	Contains BRINSAP data of on-system bridges for the third fiscal year in the timber bridge analysis. For example, for the 2008 report, this would be the BRGON table in the fiscal year 2004 end-of-year BRINSAP snapshot database file.
TIMBER_BRG_YR4	Linked Access Table	Contains BRINSAP data of on-system bridges for the fourth fiscal year in the timber bridge analysis. For example, for the 2008 report, this would be the BRGON table in the fiscal year 2006 end-of-year BRINSAP snapshot database file.
TIMBER_BRG_YR5	Linked Access Table	Contains BRINSAP data of on-system bridges for the last fiscal year (or the report year) in the timber bridge analysis. For example, for the 2008 report, this would be the BRGON table in the fiscal year 2008 end-of-year BRINSAP snapshot database file.
TX_COUNTY	Native	Stores the names of the Texas counties and their numbers TxDOT uses for identification purpose.
TXDOT_DISTRICT	Native	Stores the names and numbers of TxDOT districts.

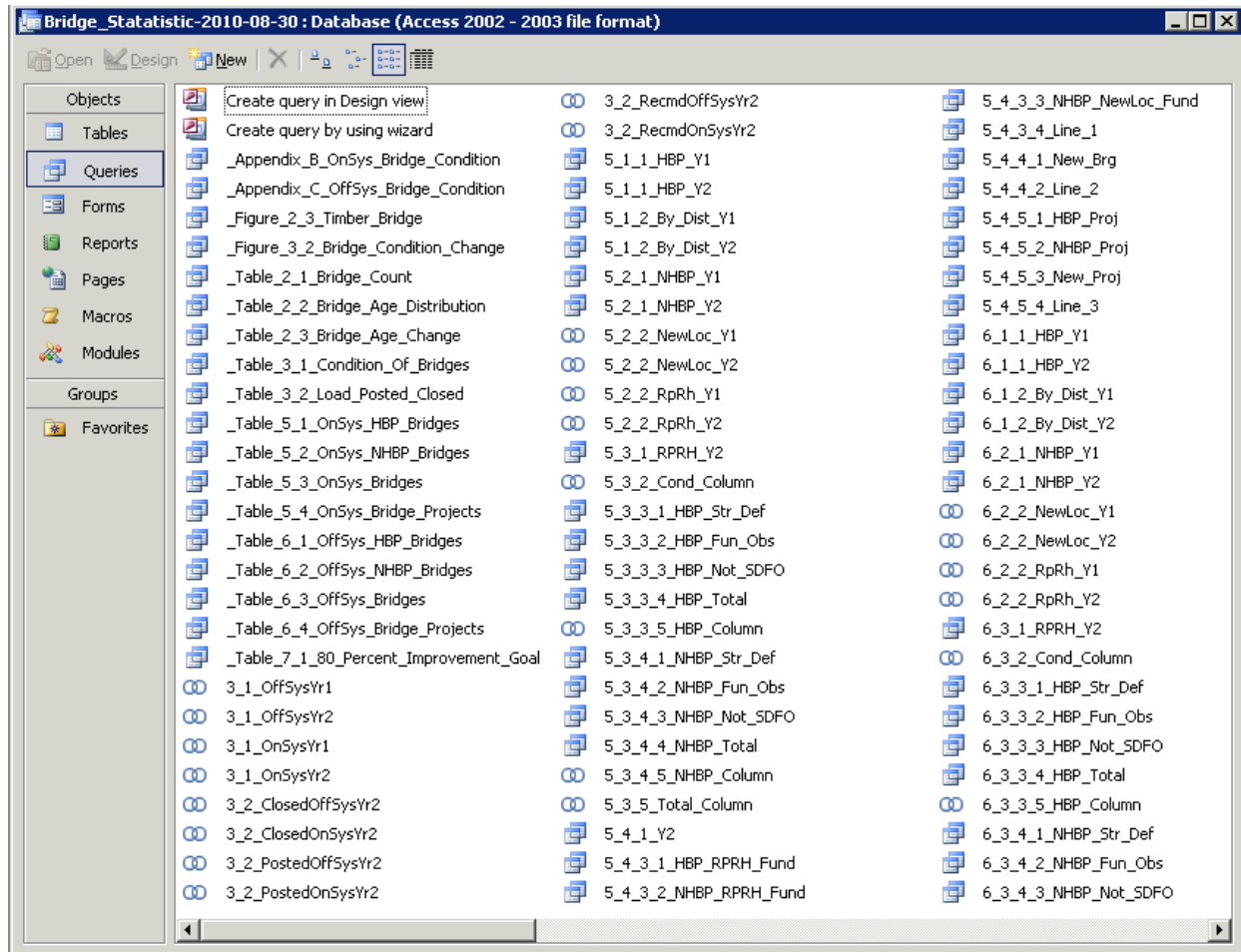


Figure 10. Queries in the Summary Bridge Statistics Prototype.

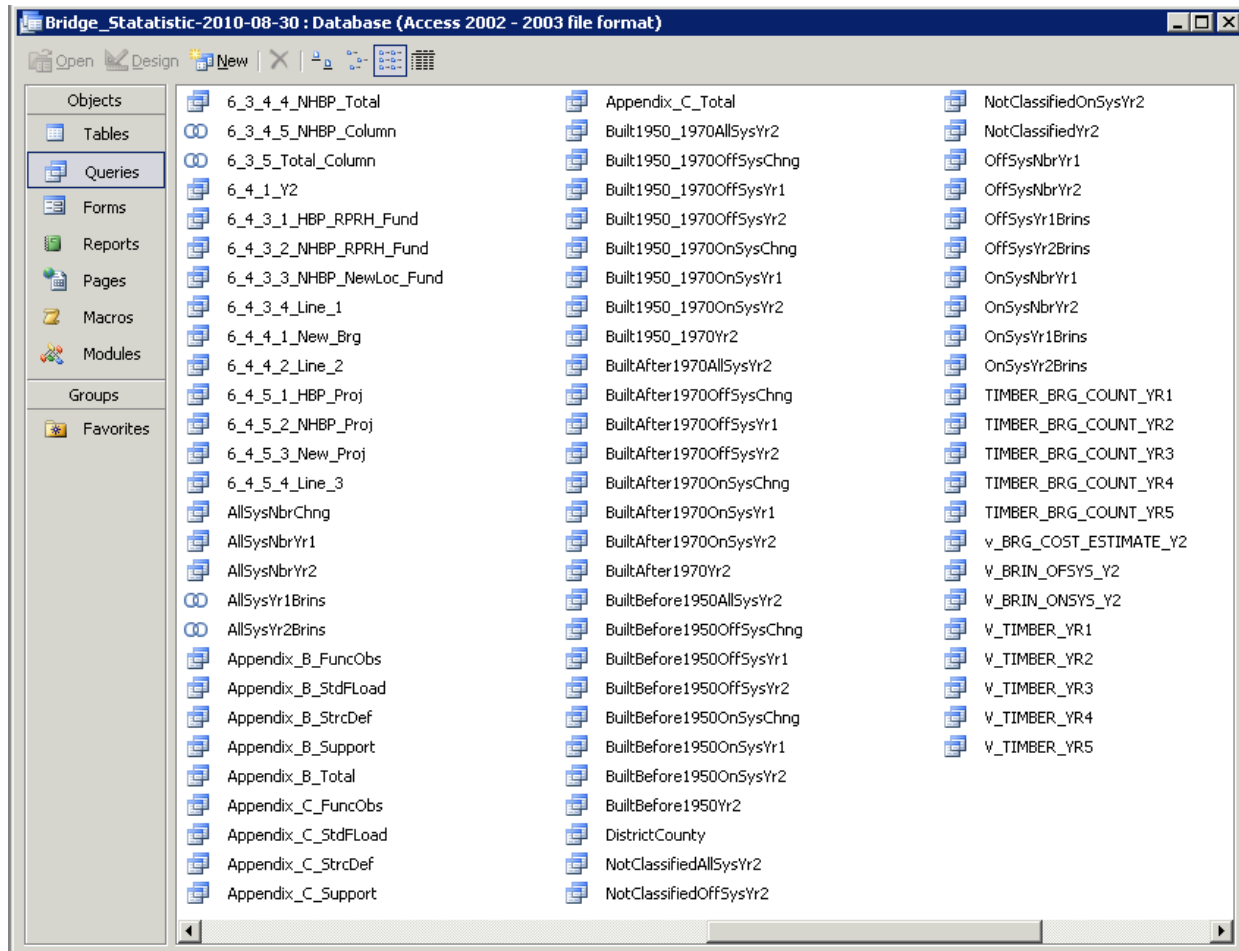


Figure 10. Queries in the Summary Bridge Statistics Prototype (continued).

Table 22. Queries in the Summary Bridge Statistics Prototype.

Main Query Name	Table or Figure to Generate	Sub-Queries Used
_Appendix_B_OnSys_Bridge_Condition	Appendix B	Appendix_B_FuncObs Appendix_B_StdFLoad Appendix_B_StrcDef Appendix_B_Support Appendix_B_Total DistrictCounty OnSysYr2Brins
_Appendix_C_OffSys_Bridge_Condition	Appendix C	Appendix_C_FuncObs Appendix_C_StdFLoad Appendix_C_StrcDef Appendix_C_Support Appendix_C_Total DistrictCounty OffSysYr2Brins
_Figure_2_3_Timber_Bridge	Figure 2-3	V_TIMBER_YR1 V_TIMBER_YR2 V_TIMBER_YR3 V_TIMBER_YR4 V_TIMBER_YR5 TIMBER_BRG_COUNT_YR1 TIMBER_BRG_COUNT_YR2 TIMBER_BRG_COUNT_YR3 TIMBER_BRG_COUNT_YR4 TIMBER_BRG_COUNT_YR5
_Figure_3_2_Bridge_Condition_Change	Figure 3-2	3_1_OffSysYr1 3_1_OffSysYr2 3_1_OnSysYr1 3_1_OnSysYr2 OffSysNbrYr1 OffSysNbrYr2 OnSysNbrYr1 OnSysNbrYr2 OffSysYr1Brins OffSysYr2Brins OnSysYr1Brins OnSysYr2Brins
_Table_2_1_Bridge_Count	Table 2-1 Figure 2-1	AllSysNbrChng AllSysNbrYr1 AllSysNbrYr2 OffSysNbrYr1 OffSysNbrYr2 OnSysNbrYr1 OnSysNbrYr2 OffSysYr1Brins OffSysYr2Brins OnSysYr1Brins OnSysYr2Brins

Table 22. Queries in the Summary Bridge Statistics Prototype (continued).

Main Query Name	Table or Figure to Generate	Sub-Queries Used
_Table_2_2_Bridge_Age_Distribution	Table 2-2 Figure 2-2	Built1950_1970AllSysYr2 Built1950_1970OffSysYr2 Built1950_1970OnSysYr2 Built1950_1970Yr2 BuiltAfter1970AllSysYr2 BuiltAfter1970OffSysYr2 BuiltAfter1970OnSysYr2 BuiltAfter1970Yr2 BuiltBefore1950AllSysYr2 BuiltBefore1950OffSysYr2 BuiltBefore1950OnSysYr2 BuiltBefore1950Yr2 NotClassifiedAllSysYr2 NotClassifiedOffSysYr2 NotClassifiedOnSysYr2 NotClassifiedYr2 OnSysNbrYr2 OffSysNbrYr2 AllSysYr2Brins OffSysYr2Brins OnSysYr2Brins
_Table_2_3_Bridge_Age_Change	Table 2-3	Built1950_1970OffSysChng Built1950_1970OffSysYr1 Built1950_1970OffSysYr2 Built1950_1970OnSysChng Built1950_1970OnSysYr1 Built1950_1970OnSysYr2 BuiltAfter1970OffSysChng BuiltAfter1970OffSysYr1 BuiltAfter1970OffSysYr2 BuiltAfter1970OnSysChng BuiltAfter1970OnSysYr1 BuiltAfter1970OnSysYr2 BuiltBefore1950OffSysChng BuiltBefore1950OffSysYr1 BuiltBefore1950OffSysYr2 BuiltBefore1950OnSysChng BuiltBefore1950OnSysYr1 BuiltBefore1950OnSysYr2 OffSysYr1Brins OffSysYr2Brins OnSysYr1Brins OnSysYr2Brins
_Table_3_1_Condition_Of_Bridges	Table 3-1	3_1_OffSysYr2 3_1_OnSysYr2 OffSysNbrYr2 OnSysNbrYr2 OffSysYr2Brins OnSysYr2Brins

Table 22. Queries in the Summary Bridge Statistics Prototype (continued).

Main Query Name	Table or Figure to Generate	Sub-Queries Used
_Table_3_2_Load_Posted_Closed	Table 3-2	3_2_ClosedOffSysYr2 3_2_ClosedOnSysYr2 3_2_PostedOffSysYr2 3_2_PostedOnSysYr2 3_2_RecmdOffSysYr2 3_2_RecmdOnSysYr2 OffSysYr2Brins OnSysYr2Brins
_Table_5_1_OnSys_HBP_Bridges	Table 5-1	5_1_1_HBP_Y1 5_1_1_HBP_Y2 5_1_2_By_Dist_Y1 5_1_2_By_Dist_Y2
_Table_5_2_OnSys_NHBP_Bridges	Table 5-2	5_2_1_NHBP_Y1 5_2_1_NHBP_Y2 5_2_2_NewLoc_Y1 5_2_2_NewLoc_Y2 5_2_2_RpRh_Y1 5_2_2_RpRh_Y2
_Table_5_3_OnSys_Bridges	Table 5-3	5_3_1_RPRH_Y2 5_3_2_Cond_Column 5_3_3_1_HBP_Str_Def 5_3_3_2_HBP_Fun_Obs 5_3_3_3_HBP_Not_SDFO 5_3_3_4_HBP_Total 5_3_3_5_HBP_Column 5_3_4_1_NHBP_Str_Def 5_3_4_2_NHBP_Fun_Obs 5_3_4_3_NHBP_Not_SDFO 5_3_4_4_NHBP_Total 5_3_4_5_NHBP_Column 5_3_5_Total_Column V_BRIN_ONSYS_Y2
_Table_5_4_OnSys_Bridge_Projects	Table 5-4 Figure 5-1	5_3_1_RPRH_Y2 5_3_3_4_HBP_Total 5_3_4_4_NHBP_Total 5_4_1_Y2 5_4_3_1_HBP_RPRH_Fund 5_4_3_2_NHBP_RPRH_Fund 5_4_3_3_NHBP_NewLoc_Fund 5_4_3_4_Line_1 5_4_4_1_New_Brg 5_4_4_2_Line_2 5_4_5_1_HBP_Proj 5_4_5_2_NHBP_Proj 5_4_5_3_New_Proj 5_4_5_4_Line_3 V_BRG_COST_ESTIMATE_Y2

Table 22. Queries in the Summary Bridge Statistics Prototype (continued).

Main Query Name	Table or Figure to Generate	Sub-Queries Used
_Table_6_1_OffSys_HBP_Bridges	Table 6-1	6_1_1_HBP_Y1 6_1_1_HBP_Y2 6_1_2_By_Dist_Y1 6_1_2_By_Dist_Y2
_Table_6_2_OnSys_NHBP_Bridges	Table 6-2	6_2_1_NHBP_Y1 6_2_1_NHBP_Y2 6_2_2_NewLoc_Y1 6_2_2_NewLoc_Y2 6_2_2_RpRh_Y1 6_2_2_RpRh_Y2
_Table_6_3_OnSys_Bridges	Table 6-3	6_3_1_RPRH_Y2 6_3_2_Cond_Column 6_3_3_1_HBP_Str_Def 6_3_3_2_HBP_Fun_Obs 6_3_3_3_HBP_Not_SDFO 6_3_3_4_HBP_Total 6_3_3_5_HBP_Column 6_3_4_1_NHBP_Str_Def 6_3_4_2_NHBP_Fun_Obs 6_3_4_3_NHBP_Not_SDFO 6_3_4_4_NHBP_Total 6_3_4_5_NHBP_Column 6_3_5_Total_Column V BRIN ONSYS Y2
_Table_6_4_OnSys_Bridge_Projects	Table 6-4 Figure 6-1	6_3_1_RPRH_Y2 6_3_3_4_HBP_Total 6_3_4_4_NHBP_Total 6_4_1_Y2 6_4_3_1_HBP_RPRH_Fund 6_4_3_2_NHBP_RPRH_Fund 6_4_3_3_NHBP_NewLoc_Fund 6_4_3_4_Line_1 6_4_4_1_New_Brg 6_4_4_2_Line_2 6_4_5_1_HBP_Proj 6_4_5_2_NHBP_Proj 6_4_5_3_New_Proj 6_4_5_4_Line_3 V BRG COST ESTIMATE Y2
_Table_7_1_80_Percent_Improvement_Goal	Table 7-1	3_1_OffSysYr2 3_1_OnSysYr2 AllSysNbrYr2 OnSysNbrYr2 OffSysNbrYr2 OffSysYr2Brins OnSysYr2Brins

CHAPTER 4. PROTOTYPE DATABASE APPLICATION TO EXTRACT BRIDGE COST ESTIMATE DATA

INTRODUCTION

This chapter describes the development of the prototype database application to extract data for the production of bridge cost estimates and related quality control checks. It includes a discussion about data reporting and other requirements that guided the development effort as well as a description of the process to build the prototype database application. Chapter 5 includes the corresponding installation and user guide. Appendix B includes details on the queries and the code to produce the prototype bridge reports.

REQUIREMENTS FOR THE BRIDGE COST ESTIMATE PROTOTYPE

One of the core requirements of a BMIS is system-wide ad-hoc cost reporting at the bridge bid item level. BRINSAP and DCIS do not have ad-hoc reporting capabilities. These systems are legacy-based systems with restricted user privileges. As such, any specialized query requires TSD support. In the long term, though a customized BMIS may extract bridge cost-related data, in the short term, extraction of bridge cost-related data can be accomplished through use of replicated DCIS files.

The overall objective for this prototype database application is to develop a collection of tools to automate the reporting and extraction of bridge cost-related data at TxDOT in the short term. On a routine basis, BRG extracts, assembles, and calculates DCIS bridge cost-related attributes in a spreadsheet for further analysis. The DCIS data extraction uses several independent scripts, provided by TSD, which retrieve:

- all Category 6 (Cat 6A, 6B, RGS) projects from DCIS,
- Record Type 12 data from DCIS
- data from the BCI screen in DCIS,
- data for all projects in DCIS that have been let (Actual Let Date <> 0000),
- data for all projects that have a NBI number on the P3B screen in DCIS,
- data for all projects in DCIS that have not been let (Actual Let Date = 0000),
- data from the P3B screen for one letting month, and
- data from DCIS for all projects that have a NBI number on the P3B screen.

BRG staff manually assembles and combines these datasets to reduce redundancy and eliminate multiple matches. The final data set, which is used for further analysis, is assembled in a spreadsheet format (internally called the “Worktable”) and contains the following attributes:

- **ACTL_LET_DT**: Actual letting date;
- **CCSJ**: Contract CSJ (project number, which may include several individual CSJs);
- **CSJ**: Control-Section-Job number;
- **DIST_NBR**: District number;
- **CNTY_NBR**: County number;

- **SYS:** On or Off System;
- **BRG_WRK_TYPE:** Bridge work type;
- **PROJ_CLS:** Functional classification of the roadway;
- **PROJ_NBR:** Project number;
- **NBI:** National Bridge Inventory structure number;
- **BRDG_TYPE:** Classified by beam type (or culvert);
- **BRG_COST_PCT:** Percentage of bridge costs associated with each bridge type if two or more bridge types exist on the same structure (e.g., a bridge with prestressed concrete I beam [GP-I] approach spans and a steel girder [GS-I] main span);
- **BRDG_DECK_AREA:** Deck area of bridge;
- **BRG_LENGTH:** Length of bridge;
- **PROJ_WIN_BID_AMT:** Winning bid (typically low bid) for the project, which includes roadways, bridges, and other items;
- **PROJ_EST_AMT:** Engineers estimate for the entire project;
- **BRG_EST_AMT:** Engineers estimate of bridge costs;
- **BRG_WIN_BID_AMT:** Winning bid (typically low bid) for bridge bid items;
- **BRG_WIN_BID_PCT:** Winning bid (typically low bid) for bid items per bridge type;
- **BRG_WIN_BID_UNIT_COST:** Winning bid (typically low bid) per bridge bid item unit;
- **BRG_EST_UNIT_COST:** Engineers estimate per bridge bid item unit; and
- **CATEGORY:** Project funding category.

Specific requirements for the development of the prototype included the following:

- replicate the Worktable,
- use a standalone database environment (more specifically Microsoft Access 2003),
- use generic query structures to enable the use of the prototype for any time period of interest, and
- use the live version (i.e., replicated version) of DCIS for bridge cost estimate conditions.

DEVELOPMENT OF BRIDGE COST ESTIMATE PROTOTYPE APPLICATION

Development of the prototype database application involved the following major steps, which are described in subsequent sub-sections:

- Identify the existing tables and generate lookup tables containing the data elements needed to replicate the Worktable,
- Create the reports and queries that replicate the Worktable, and
- Develop a form-based interface to facilitate user-friendly report generation.

Identifying Existing Tables and Generating Lookup Tables

Much of the bridge cost estimate prototype data use DCIS data. The researchers received partial DCIS tables that facilitated the development of preliminary summary bridge statistics queries. Though helpful, these tables represent activities at a snapshot in time, where data updates are not included. The Worktable provides the status of bridge-related costs for any given time period, relies on several complete data sources, and is based on live data. Since the Worktable relies heavily on live DCIS data, TxDOT provided the researchers restricted access to live DCIS data through the TxDOT Citrix gateway, which is discussed in Chapter 3.

The researchers examined the attributes contained in the Worktable and the replicated DCIS tables found in the COMMON_DSGN schema to identify data elements and tables needed to replicate the Worktable. From this examination, the researchers used existing live tables from the COMMON_DSGN schema, created modified tables, such as associated costs for mobilization in highway construction projects, and created new lookup tables, such as data source references. Most tables in this prototype either are imported or linked tables from DCIS. Figure 11 shows a list of tables used in the Bridge Cost Estimate prototype. Descriptions of these tables are as follows:

- **dbo_DCIS-PROJECT-INFORMATION_VW.** This file contains basic data describing highway construction and maintenance projects during the planning and development phases (Table 1). This file includes projects that have already been let, those that have been approved for construction or maintenance, and projects that have not completed the approval process. The prototype application links to this DCIS replicated file view in the SQL Server COMMON_DSGN schema.
- **dbo_DCIS-WORK-PROGRAM_VW.** This file contains information about highway construction project work programs and information about the state transportation improvement program (Table 2). The prototype application links to this DCIS replicated file view in the SQL Server COMMON_DSGN schema. This file has a record for every work program and the total allocated amount approved by the Texas Transportation Commission for that work program, with allocated amounts for each district if the funds are allocated to the districts. An example of a work program is the bank balance program, which identifies areas of need such as rehabilitation, reconstruction, safety, and preventive maintenance. Work programs are also used to identify categories of work for mobility and other types of projects authorized by the commission.
- **dbo_DCIS-PROJECT-ESTIMATE_VW.** This file contains estimated cost data for individual projects, including bridges (Table 3). The prototype application links to this DCIS replicated file view in the SQL Server COMMON_DSGN schema. In this file, cost data are specified by the following record type codes:
 - 02 - Project work category,
 - 03 - Comment line,
 - 04 - Bid item or special account,
 - 05 - Unique description or special account description,
 - 06 - Fund source,

- 07 - Bid item that has reference numbers or spec provision numbers,
 - 09 - End of bid items,
 - 10 – Bid item with a special provision number,
 - 11 - Specification list for temporary erosion item or for addendum to special provision, and
 - 12 - Bridge cost estimate.
- **dbo_DCIS_PROJ_INFO_STRUCT_DATA_VW.** This file contains bridge data for highway construction and maintenance projects. This file contains fields such as NBI number, structure number, structure type, bridge work type, bridge sufficiency rating, and bridge deficiency class. In the Adabas version of DCIS, data from this file are stored in the DCIS-PROJECT-INFORMATION file as a periodic group of fields that occurs 10 times. In the replicated version of DCIS, this file is stored as a separate table in the SQL Server COMMON_DSGN schema. The prototype application links to this table view in the SQL Server COMMON_DSGN schema.
 - **dbo_DCIS_PROJ_EST_BRDG_VW.** This file contains bridge data for highway construction projects. This file contains fields such as bridge length, bridge work type, NBI, bridge type, deck area, and cost percent. In the Adabas version of DCIS, data from this file is stored in the DCIS-PROJECT-ESTIMATE file as a periodic group of fields that occurs 10 times. In the replicated version of DCIS, this file is stored as a separate table in the SQL Server COMMON_DSGN schema. The prototype application links to this table view in the SQL Server COMMON_DSGN schema.
 - **DCIS_BRG_REMOVAL.** This table contains costs for removal of old structures in highway construction projects. This table contains fields such as control section, card type, bid item number, project removal cost estimate, and project removal winning cost bid. This table links to a Microsoft Access database table located on the Citrix server.
 - **DCIS_PROJ_MOBIL.** This table contains bid items and associated costs for mobilization in highway construction projects. This table contains fields such as CCSJ, CSJ, bid item number, actual let date, card type, project mobilization cost estimate, and project mobilization winning cost bid. This table links to a Microsoft Access database table located on the Citrix server.
 - **BRG_WORK_TYPE.** This table is a lookup table for bridge work types found in the DCIS P3B screen and BCI screen. Bridge work types include: replace, widen, maintain/repair, rehab, and remove/new. The prototype application contains this table.
 - **FY_LET_YEAR.** This table contains a list of valid letting years (i.e., 1993 to 2011) for the prototype application. This table is used to define a fiscal letting year for project estimate data queries. The prototype application contains this table.
 - **BIDITEM_DSCR.** This table is a lookup table for bid items used in highway construction projects. This table contains fields such as bid item number, spec book year,

bid item description, and bid item unit. The prototype application links to a Microsoft Access database table located on the Citrix server

- **LET_MONTHS.** This table is a lookup table of valid letting months (i.e., January to December) for the prototype application. This table is used to define a date range for project estimate data queries. The prototype application contains this table.
- **PROJ_REPORT_TYPE.** This table is a lookup table of report types for the prototype application. The prototype application contains this table. This table contains the following report types:
 - All Records,
 - Bridge Bid Items,
 - Bridge Cost Estimates,
 - Unmatched CSJs,
 - Total Bridge Cost Percentages not 100 percent, and
 - Total Project Cost Percentages not 100 percent.
- **DATA_SOURCE.** This table is a lookup table containing a list of external database sources for the prototype application. The table contains fields such as data source table name, data source type (e.g., DCIS, ACCESS), and data source location (e.g., TXDB22-COMMON_DSGN). The prototype application contains this table.
- **GLOBAL_PARAM.** This table contains data that allow permitted access to COMMON_DSGN table views. These data include user ids, passwords, server names, and database names. The prototype application contains this table.

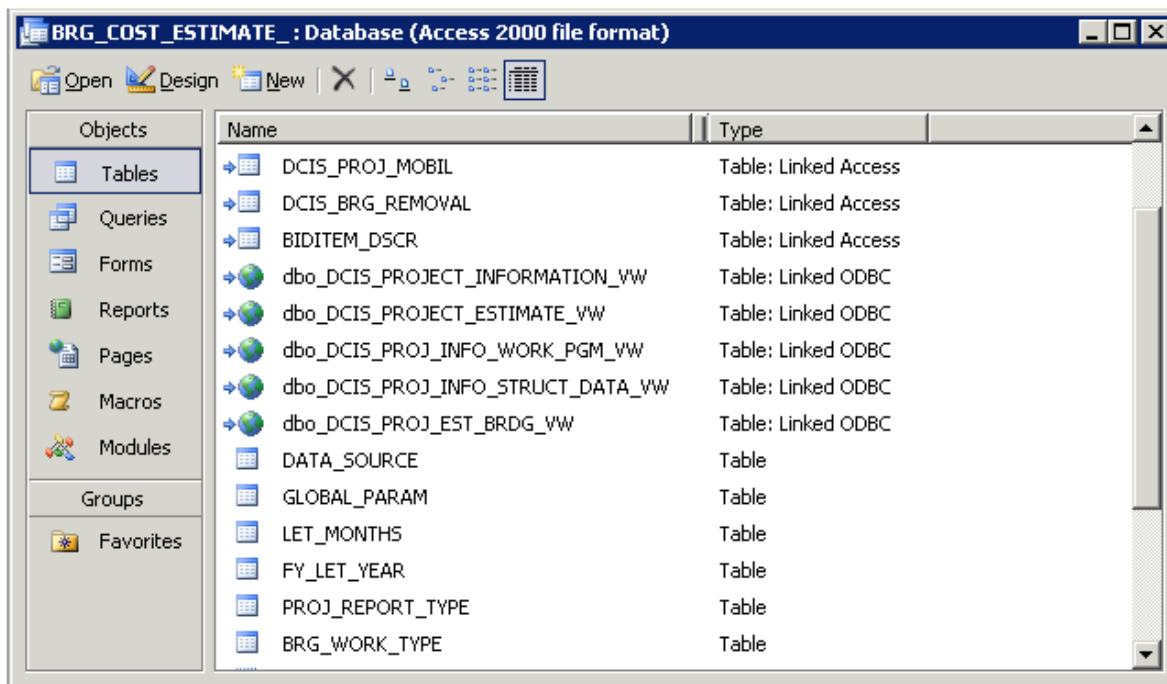


Figure 11. Tables in the Bridge Cost Estimate Prototype.

Creating Bridge Cost Estimate Prototype Queries and Reports

Concurrent with data element identification and table creation, the researchers built a set of SQL queries (Figure 12), activated through Visual Basic® (VB) code, to replicate the Worktable and generate other reports for a given fiscal year or month range. The queries and data structures used to create the reports in the Bridge Cost Estimate prototype are described in Appendix B. These reports include:

- **Project Estimate.** This report contains all records and attributes from the DCIS-PROJECT-ESTIMATE file.
- **Bridge Bid Items.** This report contains records from the DCIS-PROJECT-ESTIMATE file that have bridge-related bid items.
- **Total Bridge Cost Estimate.** This report contains total costs for individual bridges by adding the costs of all work items associated with individual bridges. This table includes one record for each bridge included in a project.
- **Disaggregated Bridge Cost Estimate (i.e., Worktable).** This report contains bridge cost data disaggregated by bridge cost percentages. This table may contain more than one record per bridge depending on the allocation of bridge cost percentages. This table uses the Total Bridge Cost Estimate table as input to the process.
- **Unmatched CSJs.** This report contains CSJs found in the DCIS-PROJECT-INFORMATION file that are not found in the Worktable.
- **Total Bridge Cost Percentages not 100 percent.** This report contains CSJs for which the total bridge cost percentages are under or over 100 percent but do not add up to 100 percent.
- **Total Project Cost Percentages not 100 percent.** This report contains CSJs for which the total project cost percentages are under or over 100 percent but do not add up to 100 percent.

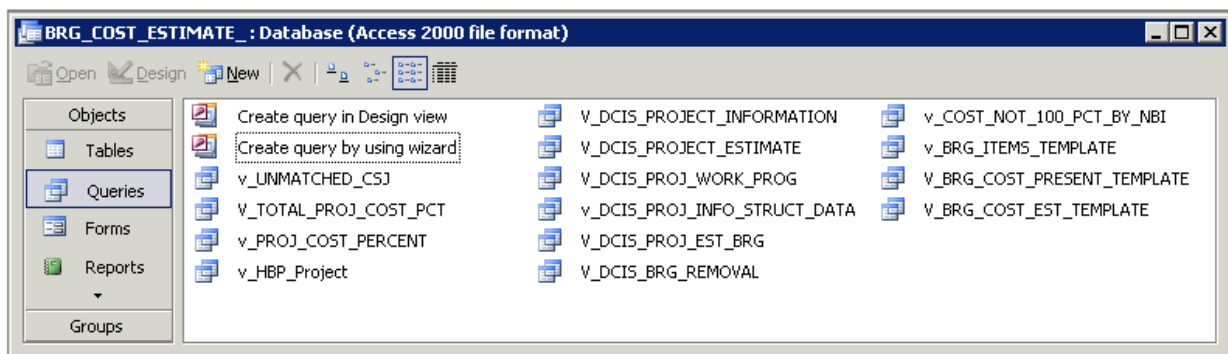


Figure 12. Queries in the Bridge Cost Estimate Prototype.

Developing Bridge Cost Estimate Prototype Interface

Once the prototype tables, queries, and reports were created, the researchers developed a user-friendly GUI to help users generate bridge cost estimate reports. A specific requirement for the development of the prototype was to use a standalone database environment. Chapter 5 (Prototype Installation and User Guides) provides more information on this application and provides screen captures of the prototype interface.

The development environment for the prototype application was Microsoft Access 2003 since this software was already installed on the Citrix desktop environment. For simplicity, the prototype used multi-tabbed forms, which include:

- **Introduction.** This tab form provides brief background information on the application.
- **Bridge Reports.** This tab form creates a specific bridge report, from a list of report types, for a defined fiscal year or a range of months.
- **Report Options.** This tab form allows users to select the specific fields to include in a bridge report.
- **Export Tables.** This tab form creates a Microsoft Access file called DATA_EXPORT.mdb and exports a selected bridge report to that Access file.

On each of the tab forms are controls (e.g., list boxes, check boxes, option buttons) that set preferences, such as letting year. Also on these tab forms are command button controls. These buttons (e.g., Export Data) run VB functions and subroutines when the button is activated (i.e., clicked). The VB functions and subroutines open, run, and present the output of the bridge cost estimate SQL queries. The interface development tools (e.g., forms, controls, and the VB coding environment) for the prototype are standard in Microsoft Access; no additional software was required to develop the prototype.

CHAPTER 5. PROTOTYPE INSTALLATION AND USER GUIDES

INTRODUCTION

This chapter includes the installation and user guides for the Summary Bridge Statistics and the Bridge Cost Estimate prototype database applications described in Chapter 3 and 4, respectively. Although there are common elements in the prototypes, for simplicity this guide covers each prototype application separately.

PROTOTYPE DATABASE APPLICATION TO EXTRACT SUMMARY BRIDGE STATISTICS

Summary Bridge Statistics Installation Guide

This section describes the process to install and setup the Summary Bridge Statistics prototype application. To run the prototype, Microsoft Access 2003 or later should already be installed. Installation of this prototype requires the following steps:

Prepare Data Sources

- Copy the 0-6389-P1 folder that contains the prototype application from the 0-6389-P1 DVD to a local drive (e.g., D:\). The Summary Bridge Statistics application, BRG_STATISTICS-2010-09-01.mdb, is located in the 0-6389-P1\Bridge_Statistics\ subfolder.
- End-of-year BRINSAP database files from 2003 to 2008 are stored in the \0-6389-P1\Bridge_Statistics\Data_Sources\BRINSAP\ subdirectory. Add updated or new end-of-year BRINSAP database files to this directory.
- Add an ODBC data source for DCIS data. This prototype links to replicated DCIS data tables residing on a TxDOT server within a SQL Server database and therefore requires an ODBC data source to be created first. Perform the following steps to add an ODBC data source:
 - Click Start > Programs > Administrative Tools > Data Sources (ODBC) (Figure 13). The ODBC Data Source Administrator dialog box appears.

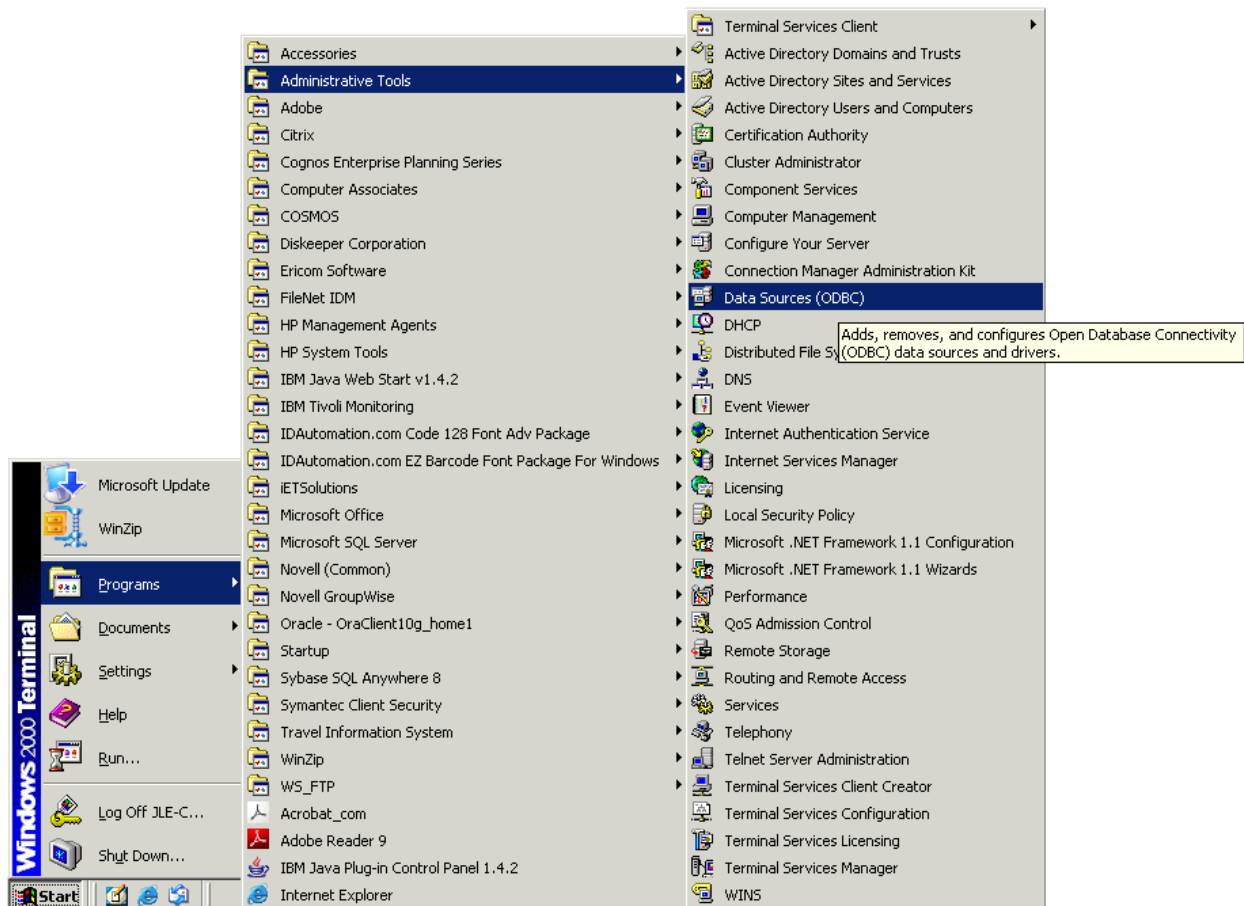


Figure 13. Add an ODBC Data Source.

- On the ODBC Data Source Administrator dialog box, click the System DSN tab and click the Add button (Figure 14). The Create New Data Source dialog box appears.

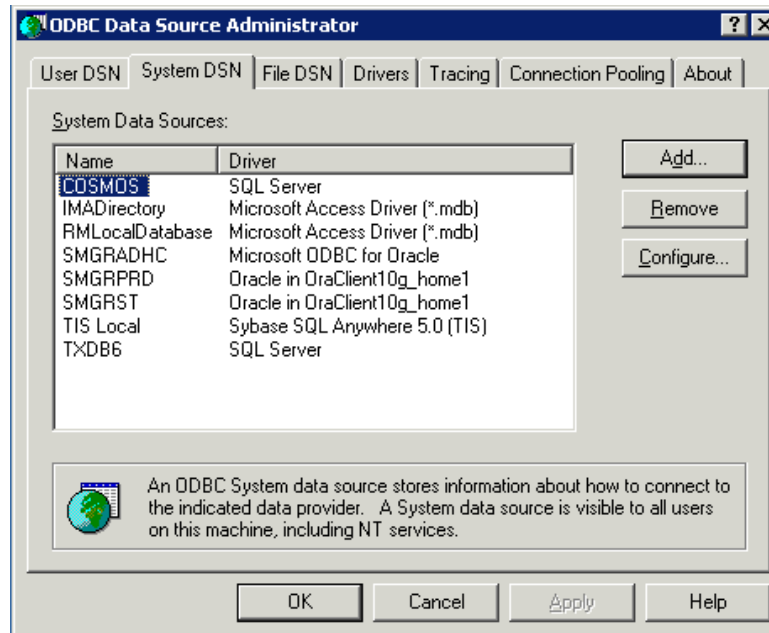


Figure 14. ODBC Data Source Administrator Dialog Box.

- On the Create New Data Source dialog box, scroll down and select SQL Server driver on the data source driver list and click the Finish button (Figure 15).

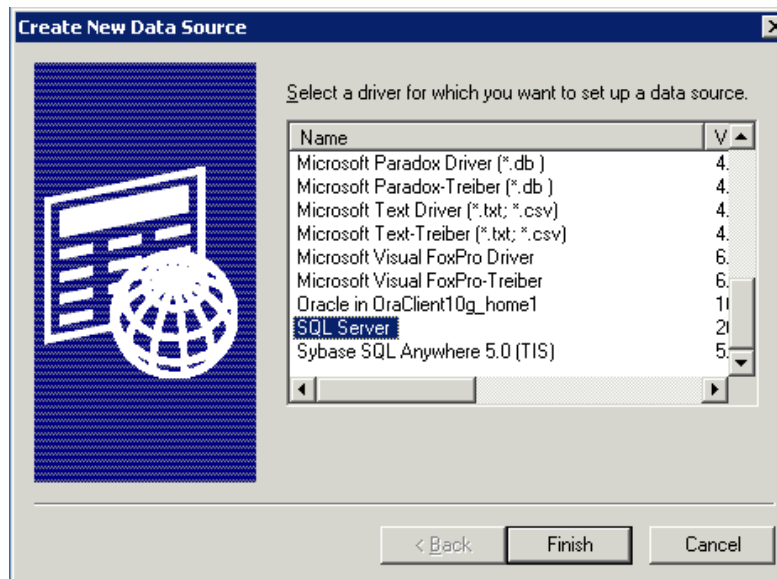


Figure 15. Create New Data Source Dialog Box.

- On the Create a New Data Source to SQL Server dialog box, enter DCIS Tables in the name field and a brief description about the data source, select TXDB22 on the Server dropdown list, and then click the Next button (Figure 16).

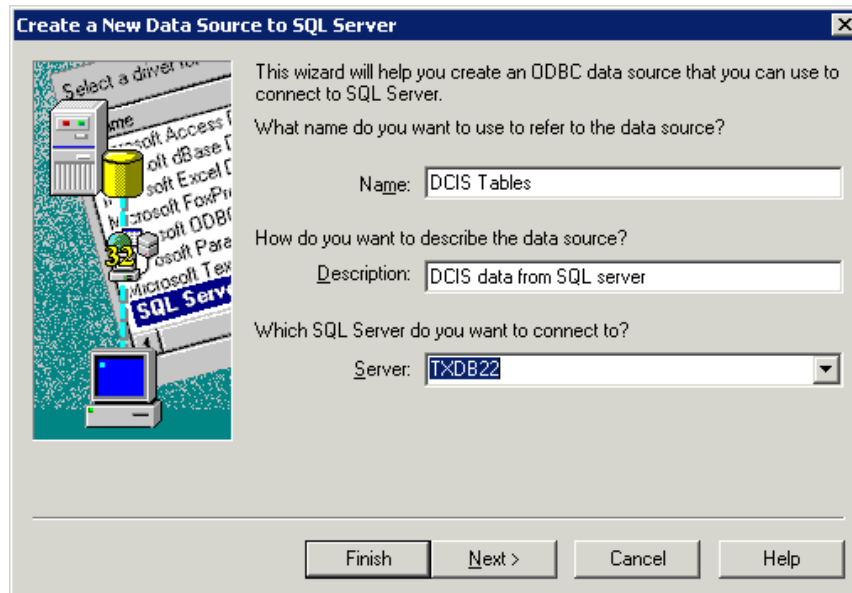


Figure 16. Create a New Data Source to SQL Server Dialog Box.

- On the subsequent SQL Server authentication dialog box, select the “With SQL Server authentication using a login ID and password entered by the user” radio

button. Enter the SQL Server login ID and password and then click the Next button (Figure 17).

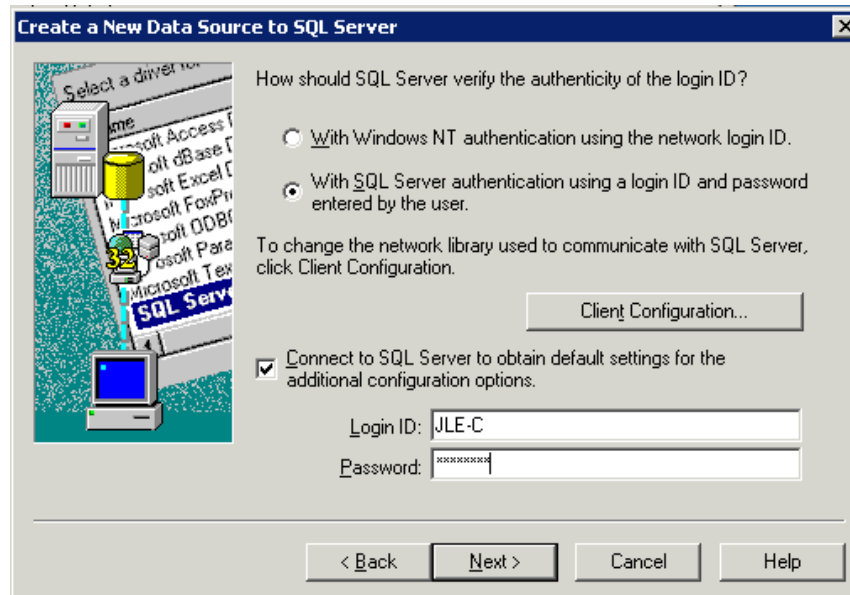


Figure 17. SQL Server User Authentication Configuration.

- On the subsequent SQL Server database setting dialog box, keep the default settings and click the Next button (Figure 18).

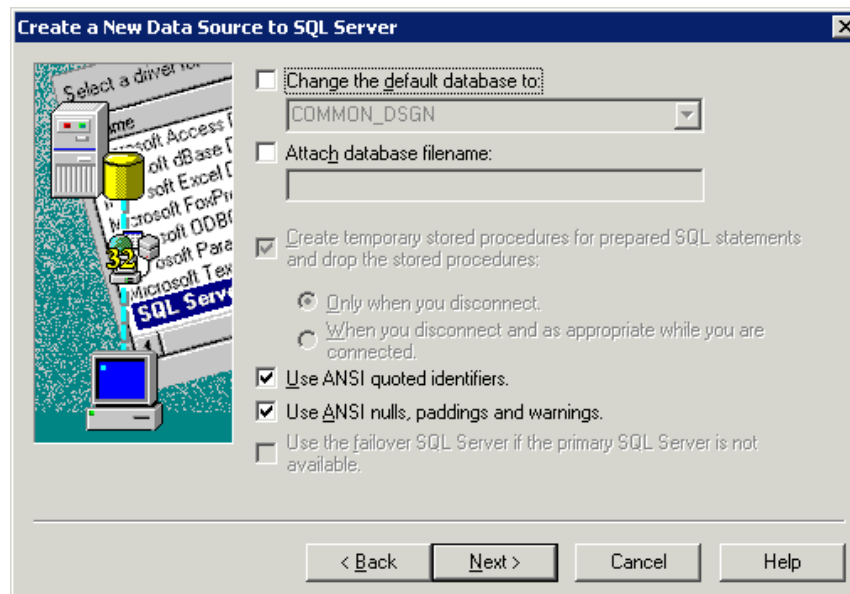


Figure 18. SQL Server Database Settings.

- On the subsequent SQL Server database setting dialog box, keep the default settings and then click the Finish button (Figure 19). Click the OK button on the ODBC Microsoft SQL Server Setup confirmation dialog box.

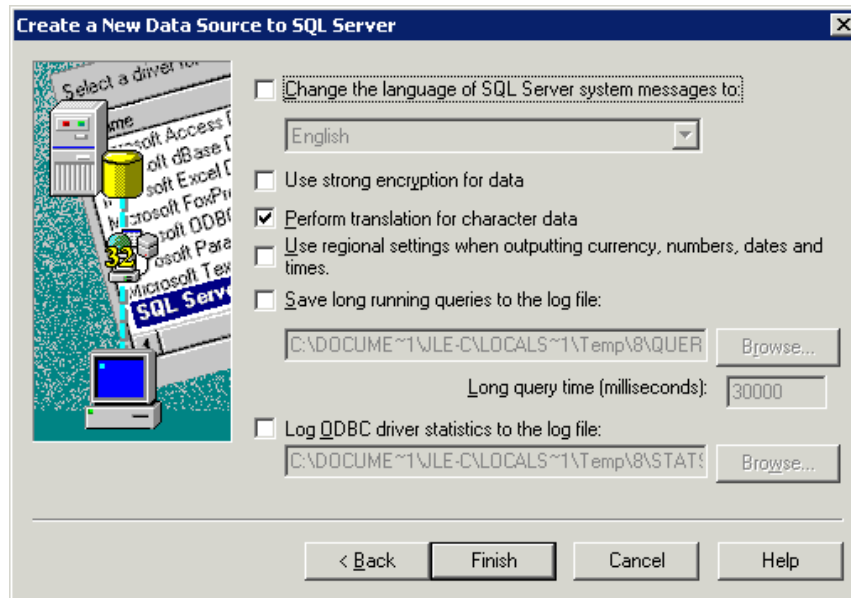


Figure 19. Additional SQL Server Database Settings.

- The DCIS Tables data source is now ready to use (Figure 20). Click the OK button on the ODBC Data Source Administrator dialog box to close it.

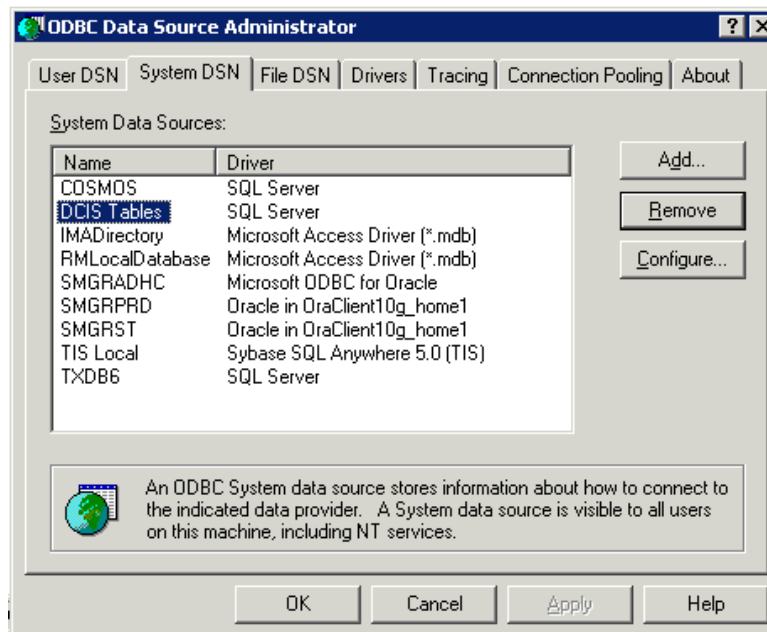


Figure 20. The DCIS Tables Data Source Is Added.

Update Cost Estimate Table

- Double click the BRG_STATISTICS-2010-09-01.mdb file located in the newly created Bridge_Statistics folder (e.g., D:\0-6389-P1\Bridge_Statistics) to open the prototype application.
- Use the following steps to update the BRG_COST_ESTIMATE_Y2 table (Note: this table contains 2008 bridge cost estimate data produced by the Bridge Cost Estimate prototype application and this table needs to be updated to reflect report year information):
 - Use the Bridge Cost Estimate prototype to generate a new bridge cost table (i.e., BRG_COST_ESTIMATE_Y2) for the report year. For example, if the Summary Bridge Statistics application is used for creating the 2010 bridge report, the BRG_COST_ESTIMATE_Y2 table should contain 2010 bridge cost information. The Bridge Cost Estimate User Guide, Step 5: Create Bridge Cost Estimate and Worktable described later in this chapter provides details on generating the bridge cost estimate table.
 - When generating the bridge cost table, select the following fields on the Report Options tab to be included in the output table:

CSJ,
Let Date,
CCSJ,
Category p2,
System,
Bridge Work Type,
NBI,
WB Project,
WB Bridge, and
WB Bridge Pct.

- Export the newly generated table (i.e., BRG_COST_REPORT_XXXX where XXXX indicates the report year) to the Summary Bridge Statistics database by right clicking the table and selecting Export...
- Delete the existing BRG_COST_ESTIMATE_Y2 table and rename the newly imported table to BRG_COST_ESTIMATE_Y2.

Update Table Links

- Click Tools > Database Utilities > Linked Table Manager to open the Linked Table Manager window (Figure 21).

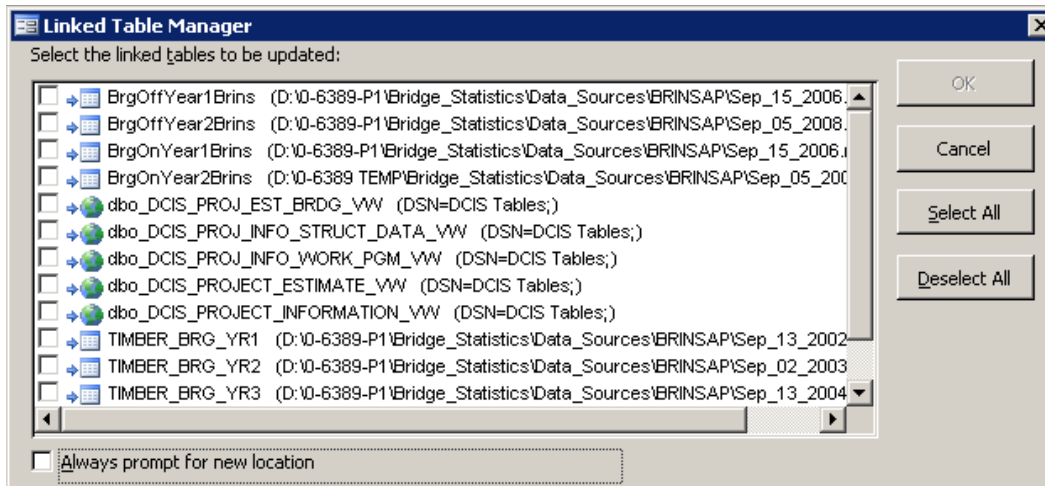


Figure 21. Linked Table Manager Window.

- In the Linked Table Manager window, click the Select All button and then click the OK button to update table links. Note: This application contains two types of linked tables: linked Access tables and linked SQL Server tables (mainly DCIS). As Figure 9 and Figure 21 show, the icons for the two types of linked tables are different. See Table 21 for detailed descriptions of the linked tables.
- For each Access database table with a missing and/or broken link, Access shows a Select New Location dialog box for users to locate the correct file (e.g., Figure 22 is the Select New Location dialog box for the TIMBER_BRG_YR1 table). Select the correct database file using the Select New Location dialog box. See Table 21 for descriptions of the tables in the prototype application.

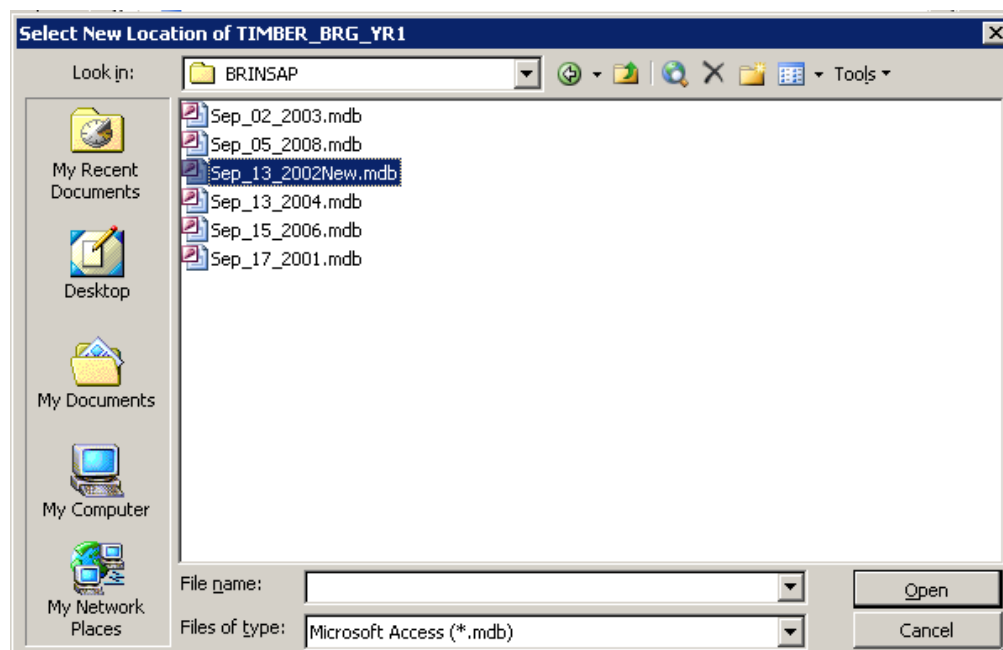


Figure 22. Dialog Box to Select New Data Source for Year 1 Timber Bridges.

- For each SQL Server table with a missing and/or broken link, Access shows a Select Data Source dialog box (Figure 23). Use the following steps to update the table link:

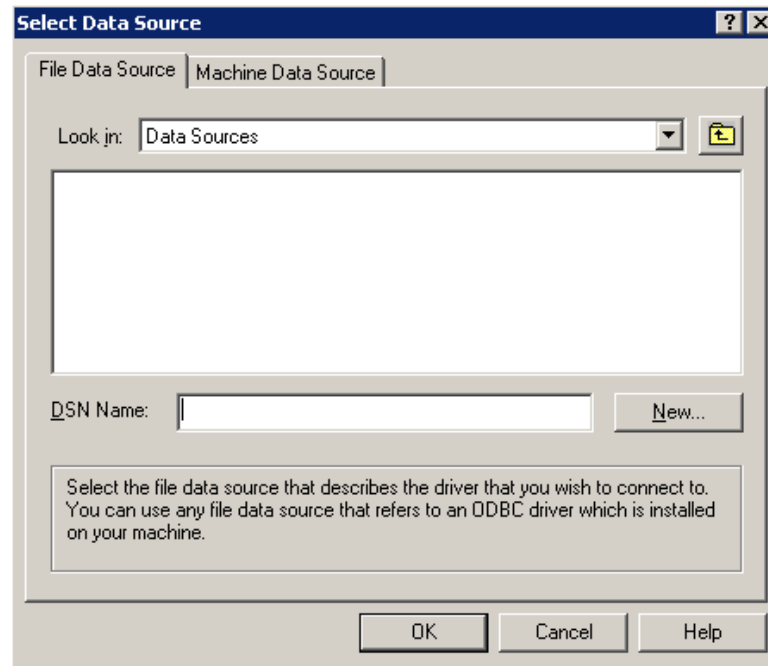


Figure 23. Select Data Source Dialog Box.

- On the Select Data Source dialog box, click Machine Data Source tab, select DCIS Tables, and then click the OK button (Figure 24).

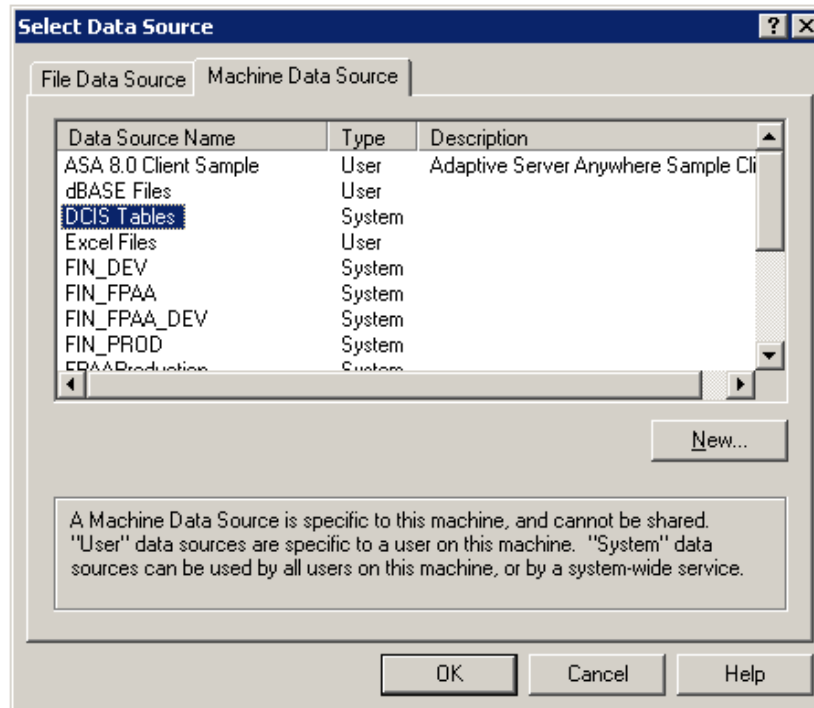


Figure 24. Select Machine Data Source Dialog Box.

- In SQL Server Login dialog box, enter a SQL Server account login ID and password, and then click the OK button (Figure 25).

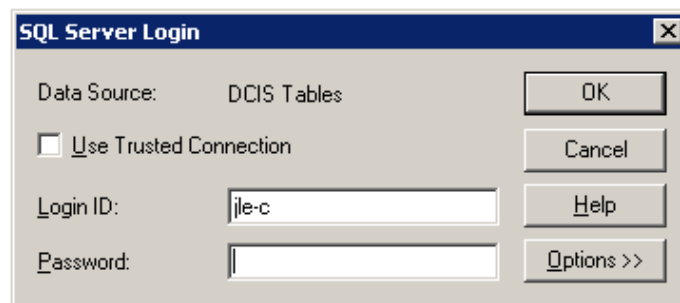


Figure 25. SQL Server Login ID and Password Dialog Box.

- In the Link Tables dialog box, select the correct table and then click the OK button (Figure 26). Note: If a dialog box appears asking to select a unique record identifier, do not select any field. Just click OK to continue.
- The summary bridge statistics prototype application is now ready to use.

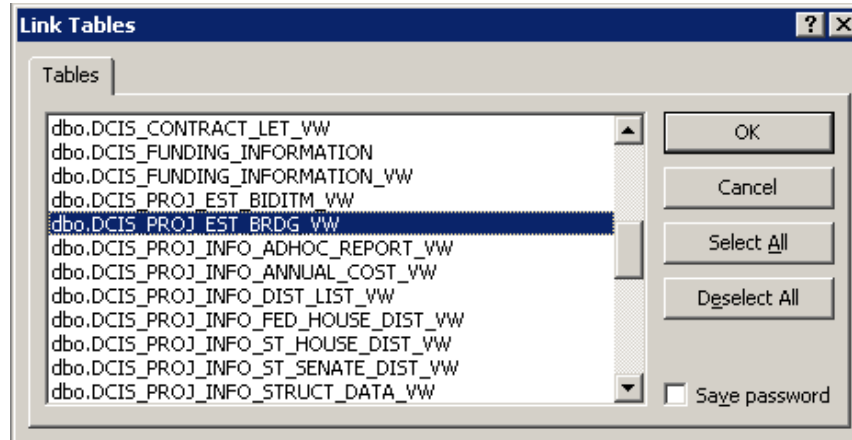


Figure 26. Link Tables Dialog Box.

Summary Bridge Statistics User Guide

This section describes the procedure to use the prototype database application to extract summary bridge statistics.

Load Bridge Summary Statistics Form

- Double click the BRG_STATISTICS-2010-09-01.mdb file located in the Bridge_Statistics folder (e.g., D:\0-6389-P1\Bridge_Statistics) to open the prototype application.
- Under Objects > Forms, double click Summary_Statistics (Figure 27). The form opens showing the Introduction tab by default (Figure 28).

Note: In some cases, users may get one or several “GetTableList: Error happening” messages (Figure 29) when first using the application. The errors are caused when the Form fails to link to the default linked tables. If this happens, ignore the messages and click the OK button to proceed.

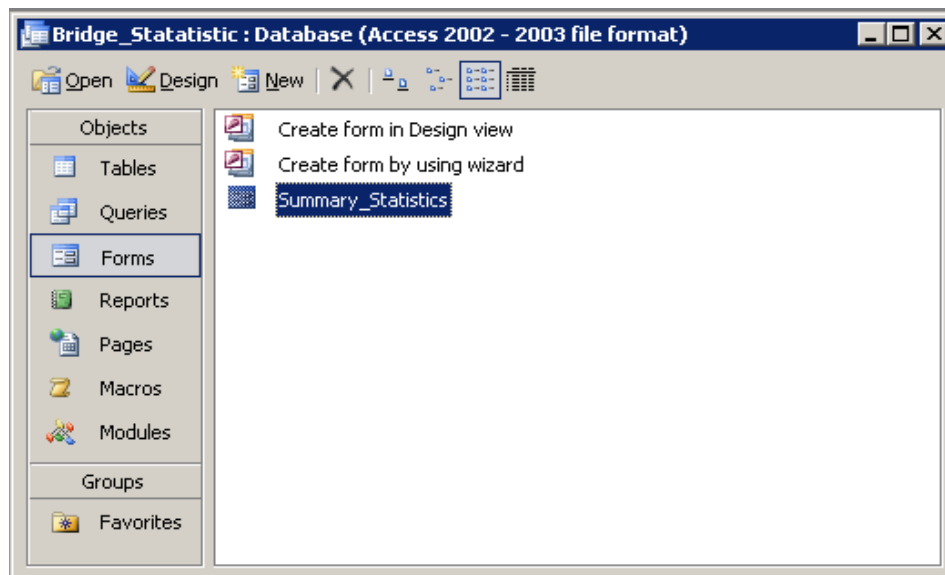


Figure 27. Summary Bridge Statistics Form under Forms.

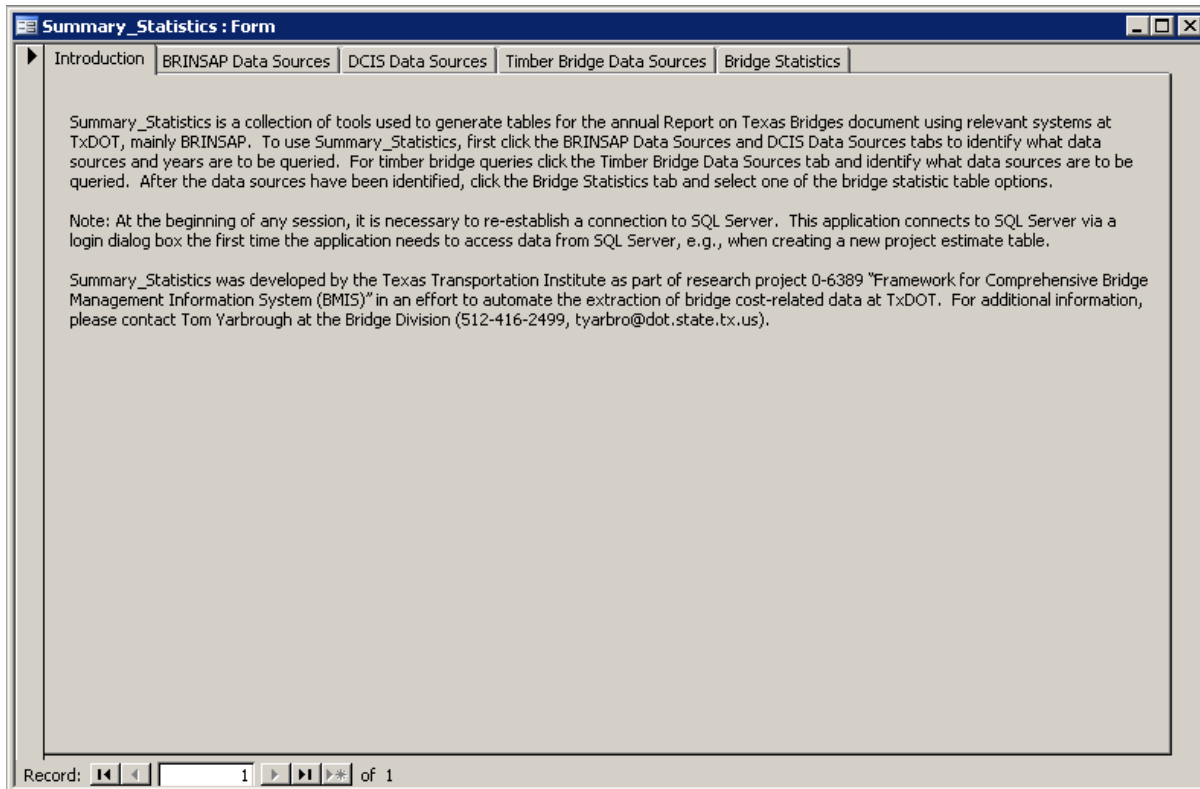


Figure 28. Introduction Tab.

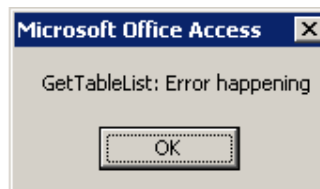


Figure 29. GetTableList Error Message.

Select BRINSAP Data Sources

- Click the BRINSAP Data Sources tab to select the appropriate source data tables (Figure 30). The application enables users to select the On- and Off- system bridge tables from

the BRINSAP Access databases created for the current fiscal year and a previous fiscal year for comparison purpose.

Note: The Year 2 database should contain the BRINSAP data for the current year and Year 1 should contain data for an earlier year as needed for certain comparison analyses. For example, to generate Table 2-1 (Count of On- and Off-system Bridges) in the 2008 report, Year 1 represents 2006 data and Year 2 represents 2008 data. The Access database file for a particular year is a snapshot (taken typically in September of that year) of BRINSAP data that contains the bridge data up to the time of the snapshot.

- Select the on- and off- system tables from the Year 1 drop-down lists. The BRGON and BRGOF tables in the 2006 BRINSAP database are selected by default.
- Select the on- and off- system tables from the Year 2 drop-down lists. The BRGON and BRGOF tables in the 2008 BRINSAP database are selected by default.
- Click the Change Data Source... buttons to select a different database file if necessary.

Summary_Statistics : Form

Introduction | **BRINSAP Data Sources** | DCIS Data Sources | Timber Bridge Data Sources | Bridge Statistics

Select the BRINSAP data sources for Year 1 and Year 2 before running Bridge Summary Statistics queries. The files must be in Access format and located in the D:\0-6389-P1\Bridge_Statistics\Data_Sources\BRINSAP\ folder. Make sure each file includes at least one table for on-system bridges (e.g., BRGON) and at least one table for off-system bridges (e.g., BRGOF). Go to the DCIS Data Sources tab to check that the Year 1 and Year 2 values match with the BRINSAP Data Sources

Notes:

- For queries that involve one year (e.g., _Table_5_3_OnSys_Repl_Rehab), the application uses the Year 2 data source.
- For queries that involve two years (e.g., _Table_5_2_OnSys_NHBP_Projects), make sure Year 1 is the earlier year and Year 2 is the later year.
- For the timber bridge query, which involves five years, go to the Timber Bridge Data Sources tab.

The Summary Statistics reports in this application use two databases that are accessed differently: BRINSAP Microsoft Access databases, created at the end of each fiscal year, and a live connection to a DCIS Microsoft SQL Server database. Due to the differences in database access, this application has two separate tabs (BRINSAP Data Sources and DCIS Data Sources) to ensure correct selection of reporting years.

Year 1: Sep_15_2006.mdb Change Data Source...

Select on-system table:

Select off-system table:

Year 2: Sep_05_2008.mdb Change Data Source...

Select on-system table:

Select off-system table:

Record: 1 of 1

Figure 30. Selection of BRINSAP Data Sources.

Select DCIS Data Sources

- Click the DCIS Data Sources tab to select the appropriate DCIS source data files (Figure 31). Some comparison analyses require additional information from DCIS (e.g., Table 6-1 [Off-System Bridges Awarded in Highway Bridge Projects (HBP) Projects] in the 2008 report). For those analyses, users need to select the DCIS data for the current fiscal year (i.e., Year 2) and an earlier fiscal year (i.e., Year 1).
- Select the correct years from the Year 1 and Year 2 drop-down lists. By default, the application specifies 2006 for Year 1 and 2008 for Year 2.

Note: Year 1 and Year 2 should match the corresponding years for which BRINSAP Access databases are selected on the BRINSAP Data Sources tab.

The screenshot shows a software window titled "Summary_Statistics : Form". It has a tabbed interface with five tabs: "Introduction", "BRINSAP Data Sources", "DCIS Data Sources" (which is the active tab), "Timber Bridge Data Sources", and "Bridge Statistics".

Inside the "DCIS Data Sources" tab, there is instructional text: "Select the value from the drop boxes below for Year 1 and Year 2 before running Bridge Summary Statistics queries. Go to the BRINSAP Data Sources tab to check that the Year 1 and Year 2 values match with the DCIS Data Sources."

Below this text is a "Notes:" section with three bullet points:

- For queries that involve one year (e.g., _Table_5_3_OnSys_Repl_Rehab), the application uses the Year 2 value.
- For queries that involve two years (e.g., _Table_5_2_OnSys_NHBP_Projects), make sure Year 1 is the earlier year and Year 2 is the later year.
- For the timber bridge query, which involves five years, go to the Timber Bridge Data Sources tab.

Further down, another paragraph explains: "The Summary Statistics reports in this application use two databases that are accessed differently: BRINSAP Microsoft Access databases, created at the end of each fiscal year, and a live connection to a DCIS Microsoft SQL Server database. Due to the differences in database access, this application has two separate tabs (BRINSAP Data Sources and DCIS Data Sources) to ensure correct selection of reporting years."

At the bottom of the main content area, it says "Select year 1 and year 2 for generating report". Below this are two drop-down menus:

- "Year 1:" with a drop-down menu showing "2006".
- "Year 2:" with a drop-down menu showing "2008".

At the very bottom of the window, there is a status bar that says "Record: 1 of 1" with navigation icons.

Figure 31. Selection of DCIS Data Sources.

Select Timber Bridge Data Sources

- Click the Timber Bridge Data Sources tab to select the appropriate source data files (Figure 32) for analyzing timber bridges. The application enables users to select multiple years of BRINSAP data to replicate Figure 2-3 (On-System Timber Bridges by Year) in the 2008 report. This figure in the 2008 report compared the numbers of on-system timber bridges from 2002 to 2008.
- Click the Change... button for each of the five data years (i.e., Year 1–Year 5) to select the BRINSAP Access database created for the intended year. The database files of 2002, 2003, 2004, 2006, and 2008 are selected by default.
- Select the correct table for each year that contains the on-system bridge data from the corresponding drop-down list.

Summary_Statistics : Form

Introduction | BRINSAP Data Sources | DCIS Data Sources | **Timber Bridge Data Sources** | Bridge Statistics

Select data sources for Year 1 through Year 5 before running the Timber Bridge Summary Statistics query (e.g., from the ...\\Bridge_Statistics\\Data_Sources\\BRINSAP\\ folder). The files must be in Access format. Make sure each file includes at least one table for on-system bridges (e.g., BRGON).

Year 1:	Sep_13_2002New.mdb	Change ...
	Select on-system table: BRGON	
Year 2:	Sep_02_2003.mdb	Change ...
	Select on-system table: BRGON	
Year 3:	Sep_13_2004.mdb	Change ...
	Select on-system table: BRGON	
Year 4:	Sep_15_2006.mdb	Change ...
	Select on-system table: BRGON	
Year 5:	Sep_05_2008.mdb	Change ...
	Select on-system table: BRGON	

Record: 1 of 1

Figure 32. Selection of Timber Bridge Data Sources.

Create Bridge Statistics

- Click the Bridge Statistics tab (Figure 33) to generate summary tables of bridge statistics, such as those included in the 2008 report.

Note: This application was developed using the 2008 report as a template assuming the reports for subsequent years will follow the same format.

Notice that the Bridge Statistics Tables drop-down list also includes figures that appeared in the 2008 report. The application does not include functions for generating graphic presentations. Rather, the application generates tables that can be used in external applications such as Microsoft Excel to create the corresponding figures.

Summary_Statistics : Form

Introduction | BRINSAP Data Sources | DCIS Data Sources | Timber Bridge Data Sources | **Bridge Statistics**

Select the bridge summary table of interest from the drop down box. A brief description of the table of interest is provided on the right side of the form. Click the Show Table button to generate the table of interest, using data sources previously identified. The data sources are listed below. Creating this table could take anywhere from a few seconds to a couple of minutes.

Bridge Statistics Tables: Select a Table

- _Appendix_B_OnSys_Bridge_Condition
- _Appendix_C_OffSys_Bridge_Condition
- Figure_2_3_Timber_Bridge
- Figure_3_2_Bridge_Condition_Change
- Table_2_1_Bridge_Count
- Table_2_2_Bridge_Age_Distribution
- Table_2_3_Bridge_Age_Change
- Table_3_1_Condition_Of_Bridges

Show Table

BRINSAP Data sources:

Year 1: Sep_15_2006.mdb
Year 2: Sep_05_2008.mdb

DCIS Data sources:

Year 1: 2006
Year 2: 2008

Timber Bridge Data sources:

Year 1: Sep_13_2002New.mdb
Year 2: Sep_02_2003.mdb
Year 3: Sep_13_2004.mdb
Year 4: Sep_15_2006.mdb
Year 5: Sep_05_2008.mdb

Record: 1 of 1

Figure 33. Bridge Statistics Tab.

- Select the table or figure in the Bridge Statistics Tables drop-down list to generate. For the application, the researchers generalized the names of tables and figures by removing date information, simplifying names and replacing spaces and special characters with underscores. For example, as shown in Figure 34 Table_2_3_Bridge_Age_Change

corresponds to Table 2-3 Change in Age of Bridges from September 2006 to September 2008 in the 2008 report.

Notice that the application displays a brief description of the selected table under the Show Table button.

The screenshot shows a software window titled "Summary_Statistics : Form". It has a tabbed interface with five tabs: "Introduction", "BRINSAP Data Sources", "DCIS Data Sources", "Timber Bridge Data Sources", and "Bridge Statistics". The "Bridge Statistics" tab is active. Inside the window, there is a text block that reads: "Select the bridge summary table of interest from the drop down box. A brief description of the table of interest is provided on the right side of the form. Click the Show Table button to generate the table of interest, using data sources previously identified. The data sources are listed below. Creating this table could take anywhere from a few seconds to a couple of minutes." Below this text is a label "Bridge Statistics Tables:" followed by a dropdown menu showing "Table 2 3 Bridge Age Change". To the right of the dropdown is a button labeled "Show Table". Below the button, a description states: "This table contains an age distribution, with counts and differences, of Texas on- and off-system bridges at the end of fiscal years 1 and 2." At the bottom of the window, there are two columns of data sources. The left column is titled "BRINSAP Data sources:" and lists "Year 1: Sep_15_2006.mdb" and "Year 2: Sep_05_2008.mdb". The right column is titled "Timber Bridge Data sources:" and lists "Year 1: Sep_13_2002New.mdb", "Year 2: Sep_02_2003.mdb", "Year 3: Sep_13_2004.mdb", "Year 4: Sep_15_2006.mdb", and "Year 5: Sep_05_2008.mdb". Below these lists is another label "DCIS Data sources:" followed by "Year 1: 2006" and "Year 2: 2008". At the very bottom of the window, there is a record navigation bar that says "Record: 1 of 1" with navigation icons.

Summary_Statistics : Form

Introduction | BRINSAP Data Sources | DCIS Data Sources | Timber Bridge Data Sources | Bridge Statistics

Select the bridge summary table of interest from the drop down box. A brief description of the table of interest is provided on the right side of the form. Click the Show Table button to generate the table of interest, using data sources previously identified. The data sources are listed below. Creating this table could take anywhere from a few seconds to a couple of minutes.

Bridge Statistics Tables: Table 2 3 Bridge Age Change

Show Table

This table contains an age distribution, with counts and differences, of Texas on- and off-system bridges at the end of fiscal years 1 and 2.

BRINSAP Data sources:

Year 1: Sep_15_2006.mdb
Year 2: Sep_05_2008.mdb

DCIS Data sources:

Year 1: 2006
Year 2: 2008

Timber Bridge Data sources:

Year 1: Sep_13_2002New.mdb
Year 2: Sep_02_2003.mdb
Year 3: Sep_13_2004.mdb
Year 4: Sep_15_2006.mdb
Year 5: Sep_05_2008.mdb

Record: 1 of 1

Figure 34. Selection of a Table on Bridge Statistics Tab.

- Click the Show Table button to generate the table based on the selected data sources (Figure 35). If desired, copy the table into another application (e.g., Microsoft Word or Excel) for further processing.

Select the bridge summary table of interest from the drop down box. A brief description of the table of interest is provided on the right side of the form. Click the Show Table button to generate the table of interest, using data sources previously identified. The data sources are listed below. Creating this table could take anywhere from a few seconds to a couple of minutes.

Bridge Statistics Tables:

This table contains an age distribution, with counts and differences, of Texas on- and off-system bridges at the end of fiscal years 1 and 2.

BRINSAP Data sources:
 Year 1: Sep_15_2006.mdb
 Year 2: Sep_05_2008.mdb

DCIS Data sources:
 Year 1: 2006
 Year 2: 2008

Age	As of Year 1	As of Year 2	Change
On-system Bridges			
* Built before 1950	6813	6659	-154
* Built 1950 - 1970	13784	13495	-289
* Built after 1970	12076	12961	885
Off-system Bridges			
* Built before 1950	2468	2242	-226
* Built before 1950	3553	3330	-223
* Built after 1970	11132	11880	748

Record: 1 of 8

Figure 35. Change in Age of Bridges Table Generated by the Application.

- If desired, select another query from the Bridge Statistics Tables drop-down list to generate another table.

PROTOTYPE DATABASE APPLICATION TO EXTRACT BRIDGE COST ESTIMATE DATA

Bridge Cost Estimate Installation Guide

This section describes the process to install and setup the Bridge Cost Estimate prototype application. To run the prototype, Microsoft Access 2003 or later should already be installed. Installation of this prototype requires the following steps:

- Copy the 0-6389-P1 folder that contains the prototype application from the 0-6389-P1 DVD to a local drive (e.g., D:\). The Bridge Cost Estimate application, BRG_COST_ESTIMATE-2010-09-01.mdb, is located in the 0-6389-P1\Bridge_Cost_Estimate\ subfolder.
- Add an ODBC data source for DCIS data. This prototype links to replicated DCIS data tables residing on a TxDOT server within a SQL Server database and therefore requires an ODBC data source to be created first. If an ODBC data source has not been created, follow the steps in the Prepare Data Sources section of the Summary Bridge Statistics application prototype installation guide to add an ODBC data source.
- Double click the BRG_COST_ESTIMATE-2010-09-01.mdb file located in the newly created Bridge_Costs_Estimates folder (e.g., D:\0-6389-P1\Bridge_Cost_Estimates) to open the prototype application.
- Click Tools > Database Utilities > Linked Table Manager to open the Linked Table Manager window (Figure 36). Note: This application contains two types of linked tables: linked Access tables and linked SQL Server tables. See Chapter 4 for detailed descriptions of all tables.

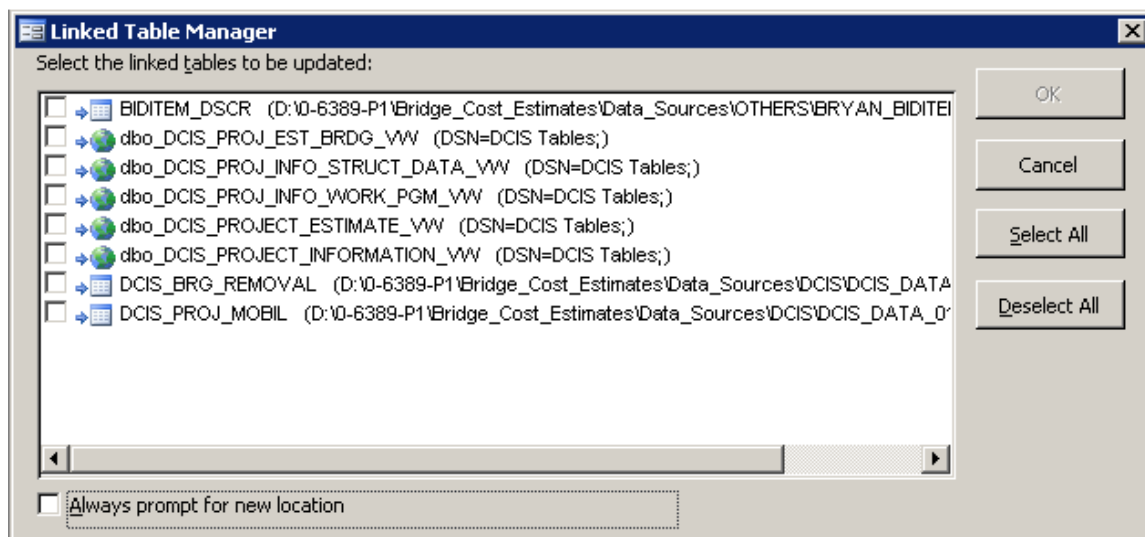


Figure 36. Bridge Cost Estimate Linked Table Manager Window.

- In the Linked Table Manager window, click the Select All button and then click the OK button to update table links.
- If prompted, enter a SQL Server account login ID and password in the SQL Server Login dialog box (Figure 25). After successfully entering a login ID and password, close the Linked Table Manager window.

If a SQL Server table has a missing and/or broken link, perform the following steps to update the table link:

- In Microsoft Access, click File > Get External Data > Link Tables. In the Link dialog box, select “ODBC Databases” for Files of type. A Select Data Source dialog box will open (Figure 23).
- Select the Machine Data Source tab and the DCIS Tables data source name (Figure 24). After clicking the OK button, enter a SQL Server account login ID and password in the SQL Server Login dialog box (Figure 25).
- After successfully entering a login ID and password the Link Tables dialog box will appear (Figure 26). In the Link Tables dialog box, select the following tables and then click the OK button:
 - dbo.DCIS_PROJ_EST_BRDG_VW,
 - dbo.DCIS_PROJ_INFO_STRUCT_DATA_VW,
 - dbo.DCIS_PROJ_INFO_WORK_PGM_VW,
 - dbo.DCIS_PROJECT_ESTIMATE_VW, and
 - dbo.DCIS_PROJECT_INFORMATION_VW.

Note: If a dialog box appears asking to select a unique record identifier for any of the views, do not select any field. Just click the OK button to continue.

- After linking the DCIS table views, they should appear listed in Access (Figure 37). The application automatically replaces “.” with “_” after the term “dbo.” The application is now ready to use.

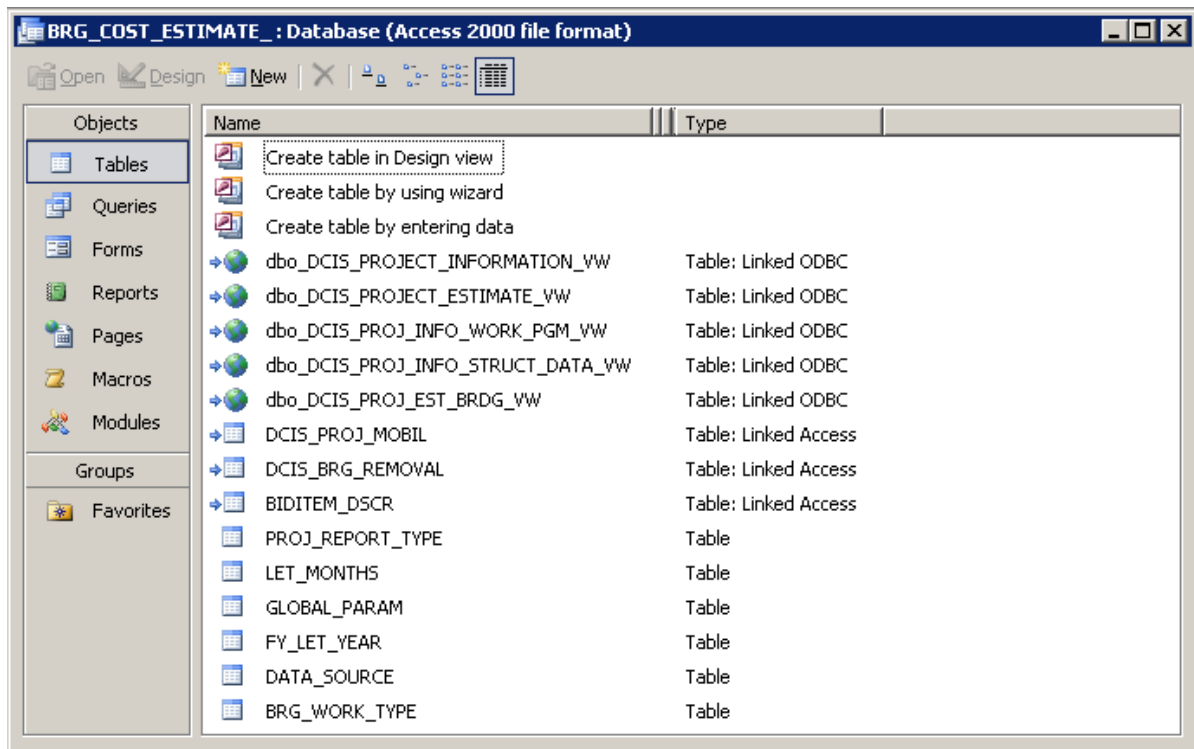


Figure 37. Bridge Cost Estimate Prototype Application Tables.

Bridge Cost Estimate User Guide

This section describes how to use the prototype application to produce bridge cost estimates and to perform quality control checks. Note: When the prototype is opened, it is necessary to re-establish a connection to SQL Server. This application connects to SQL Server via a login dialog box (Figure 25) the first time the application needs to access data from SQL Server, e.g., when creating a new project estimate table. Using the Bridge Cost Estimate prototype application involves the following steps, some of which may be optional.

Step 1: Load Bridge Cost Data Form

- Open the Microsoft Access database file called BRG_COST_ESTIMATE. Under Objects > Forms, double click the BRIDGE_COST_DATA form (Figure 38). The form opens, showing the Introduction tab by default (Figure 39).

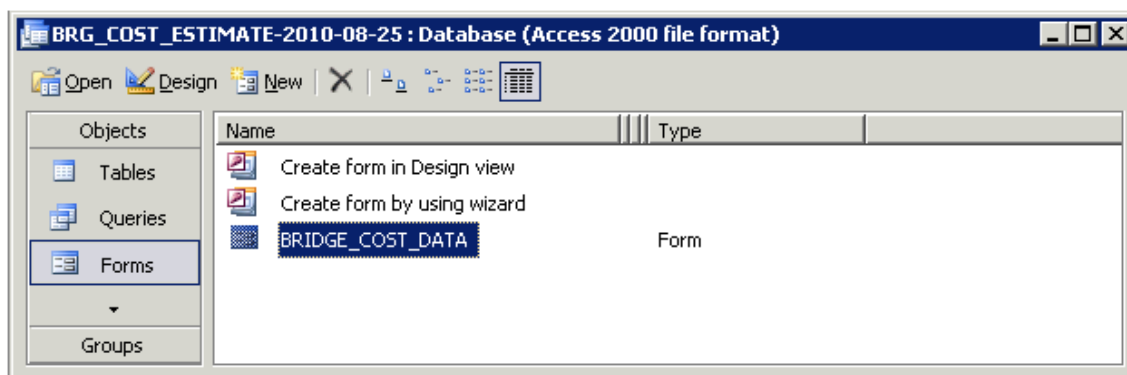


Figure 38. Forms Contained in the Bridge Cost Estimate Prototype.

A screenshot of the "BRIDGE_COST_DATA : Form" window. It has a tabbed interface with tabs for "Introduction", "Bridge Reports", "Report Options", and "Export Tables". The "Introduction" tab is active. The content area contains three paragraphs of text. The first paragraph explains the purpose of the form. The second paragraph is a note about re-establishing a connection to SQL Server. The third paragraph provides background information about the form's development. At the bottom, there is a "Record" status bar showing "1 of 1".

BRIDGE_COST_DATA is a collection of tools to extract bridge cost data from relevant systems at TxDOT, mainly DCIS. To use BRIDGE_COST_DATA, click the Bridge Reports tab and select one of the reporting options.

Note: At the beginning of any session, it is necessary to re-establish a connection to SQL Server. This application connects to SQL Server via a login dialog box the first time the application needs to access data from SQL Server, e.g., when creating a new project estimate table.

BRIDGE_COST_DATA was developed by the Texas Transportation Institute as part of research project 0-6389 "Framework for Comprehensive Bridge Management Information System (BMIS)" in an effort to automate the extraction of bridge cost-related data at TxDOT. For additional information, please contact Tom Yarbrough at the Bridge Division (512-416-2499, tyarbro@dot.state.tx.us).

Record: 1 of 1

Figure 39. Introduction Tab in BRIDGE_COST_DATA Form.

Step 2: Select Date Range

- Click the Bridge Reports tab and select a user defined date range. The application enables users to select either a fiscal year, e.g., 2009, or a month range, e.g., 03-2009 to 06-2009. As an illustration, Figure 40 shows the selection of a fiscal year.

The screenshot shows a software window titled "BRIDGE_COST_DATA: Form". It has four tabs: "Introduction", "Bridge Reports", "Report Options", and "Export Tables". The "Bridge Reports" tab is active. Inside the tab, there is a text box with instructions: "Select a let date type (fiscal year or month range), enter the date range of interest, and click Create New Table to generate a new table that contains project estimate data for the date range selected. After creating the new table, you can generate reports. Creating the new table could take anywhere from a few seconds to a couple of minutes." Below the text box are two dropdown menus. The first is labeled "Let Date Type" and has "Fiscal Year" selected. The second is labeled "Fiscal Year" and has "2009" selected. To the right of these dropdowns is a button labeled "Create New Table". At the bottom of the window, there is a status bar that says "Record: 1 of 1".

Figure 40. Selection of Date Range for Bridge Report Generation.

Step 3: Create and Display the Project Estimate Table

- Click the Create New Table button (Figure 40) in the Bridge Reports tab to generate an internal working table that contains project estimate data for the date range selected. After creating the table, the application displays a sub-menu with several bridge report types (Figure 41).

The application automatically determines if a project estimate table for the date range of interest already exists in the database file. If a project estimate table already exists, the user has the option to use the existing table or generate a new version of the table (which overrides the existing one). Creating a new project estimate table usually takes from less than a minute to about two minutes.

BRIDGE_COST_DATA:Form

Introduction Bridge Reports Report Options Export Tables

Select a let date type (fiscal year or month range), enter the date range of interest, and click Create New Table to generate a new table that contains project estimate data for the date range selected. After creating the new table, you can generate reports. Creating the new table could take anywhere from a few seconds to a couple of minutes.

Let Date Type: Fiscal Year

Fiscal Year: 2009

Create New Table

The project estimate table is available for use.

Select report type: All Records

Create Report

This option selects all records from table PROJECT_ESTIMATE_2009.

Record: 1 of 1

Figure 41. Report Menu Options.

- Once the project estimate table has been created, select the All Records report type from the pull-down box on the Bridge Reports tab. Click the Create Report button to display the project estimate report (Figure 42).

ACTUAL_LET	CONTROL_SEC	LINE_NUMBER	CARD_TYPE	BIDITEM_NO	SPEC_BOOK	BIDITEM_FLAG	ENG_QUANTIT	EN
908	000104085	0 10	04200000	04			0	
908	000104085	0 07	82510000	04			0	
908	000104085	0 10	00010000	04			0	
908	000104085	0 10	00020000	04			0	
908	000104085	0 10	00040000	04			0	
908	000104085	0 10	00050000	04			0	
908	000104085	0 10	00060000	04			0	
908	000104085	0 10	00070000	04			0	
908	000104085	0 10	00080000	04			0	
908	000104085	0 10	00090000	04			0	
908	000104085	0 10	02470000	04			0	
908	000104085	0 10	02600000	04			0	
908	000104085	0 10	03400000	04			0	
908	000104085	0 10	06820000	04			0	

Record: 1 of 127080

Figure 42. Sample Project Estimate Report.

Step 4: Create and Display Bridge Bid Items Report

- Select the Bridge Bid Items report type from the pull-down box on the Bridge Reports tab (Figure 43) and click the Create Report button to display bridge bid item data (Figure 44). Generation of the bridge bid item table also includes creation of a working table that contains bridge work items from the project estimate report.

Select a let date type (fiscal year or month range), enter the date range of interest, and click Create New Table to generate a new table that contains project estimate data for the date range selected. After creating the new table, you can generate reports. Creating the new table could take anywhere from a few seconds to a couple of minutes.

Let Date Type:

Fiscal Year:

The project estimate table is available for use.

Select report type:

This option creates table BRG_ITEMS_2009 based on records that contain bridge bid items in table PROJECT_ESTIMATE_2009.

Record: of 1

Figure 43. Bridge Bid Items Report Option.

ACTUAL_LET	CONTROL_SEC	LINE_NUMBER	CARD_TYPE	BIDITEM_NO	BIDITEM_DSCR	BIDIT
907	000211054	8010	12	00000000		
907	000211054	8100	04	01042009	REMOVING CONC (RIPRAP)	Y
907	000211054	8150	04	04002005	CEM STABIL BKFL	Y
907	000211054	8200	04	04202029	CL S CONC (SLAB)	Y
907	000211054	8300	04	04202031	CL S CONC (SHEAR KEY)	Y
907	000211054	8500	04	04252009	PRESTR CONC BOX BEAM (5B28)	Y
907	000211054	8600	04	04282001	CONC SURF TREAT (CLASS I)	Y
907	000211054	8700	04	04302002	CL C CONC FOR EXT STR (ABUT)	Y
907	000211054	8800	04	04302003	CL C CONC FOR EXT STR (BENT)	Y
907	000211054	8900	04	04322002	RIPRAP (CONC)(5 IN)	Y
907	000211054	9000	04	04382004	CLEAN AND SEAL JOINTS	Y
907	000211054	9100	04	04392011	LATEX-MODIFIED CONC OVERLAY (1.5 I	Y
907	000211054	10000	04	04502003	RAIL (TY T203)	Y
907	000211054	10100	04	04542002	SEALED EXPANSION JOINT (4 IN)SELP	Y

Record: of 6277

Figure 44. Sample Bridge Bid Items Report.

Step 5: Create Bridge Cost Estimate and Worktable

- Select the Bridge Cost Estimates report type from the pull-down box on the Bridge Reports tab (Figure 45).

BRIDGE_COST_DATA : Form

Introduction Bridge Reports Report Options Export Tables

Select a let date type (fiscal year or month range), enter the date range of interest, and click Create New Table to generate a new table that contains project estimate data for the date range selected. After creating the new table, you can generate reports. Creating the new table could take anywhere from a few seconds to a couple of minutes.

Let Date Type: Fiscal Year

Fiscal Year: 2009

Create New Table

The project estimate table is available for use.

Select report type: Bridge Cost Estimates

Create Report

This option creates table BRG_COST_EST_2009 and table BRG_COST_REPORT_2009. Before creating this report, make sure to (a) select the fields of interest from the Report Options tab and (b) run the Bridge Bid Items report.

Record: 1 of 1

Figure 45. Bridge Cost Estimates Report Option.

- Prior to clicking the Create Report button, click the Report Options tab (Figure 46) and select the fields to include in the resulting table.
- Click the Bridge Reports tab again (Figure 45), confirm that the Bridge Costs Estimates report has been selected, and click the Create Report button. The application will create the following tables:
 - Total bridge cost estimate. This table contains total costs for individual bridges using a VB script that calculates total costs by adding the costs of all work items associated with individual bridges. This table includes one record for each bridge included in a project.
 - Disaggregated bridge cost estimate table (i.e., Worktable). This table contains bridge cost data disaggregated by bridge cost percentages (Figure 47). This table may contain more than one record per bridge depending on the allocation of bridge cost percentages. This table uses the Total Bridge Cost Estimate table as input to the process.

If a bridge cost estimate table already exists in the database, the system asks the user to keep the existing table or overwrite the existing table with the new table.

BRIDGE_COST_DATA:Form

Introduction Bridge Reports Report Options Export Tables

Check the columns of interest and then return to the Bridge Reports tab to create the "BRG_COST_EST_<Date range>" table.

☒ Let Date ☒ Proj Class ☒ EE Project ☒ WB Project
☒ CCSJ ☒ Proj No ☒ EE Mobil ☒ WB Mobil
☒ CSJ ☒ NBI ☒ EE Removal ☒ WB Removal
☒ District Number ☒ Brg Type ☒ EE Brg ☒ WB Brg
☒ County No ☒ Brg Type Pct ☒ EE Brg Percentage ☒ WB Brg Percentage
☒ System ☒ Deck Area ☒ EE Brg Mobil ☒ WB Brg Mobil
☒ Category P2 ☒ Length ☒ EE by Brg Type ☒ WB by Brg Type
☒ Brg Work Type ☒ Width ☒ EE Brg Unit Cost ☒ WB Brg Unit Cost
☒ Adj Unit Price ☒ CSJ (right margin)
☒ NBI (right margin)

EE: Engineering estimate.
WB: Winning bid.

Record: 1 of 1

Figure 46. Report Options Tab.

BRG_COST_REPORT_2009:Table

Let Date	CCSJ	CSJ	Dist No	County No	System	Category p2	Brg Work Type	Proj
903	016201056	016201056			OFF	4		
903	016201056	016202024			OFF	4		
903	016201056	016202024			OFF	4		
903	016201056	016202024			OFF	4		
906	031407034	031407036			OFF	10		
906	031407034	031407036			OFF	10		
810	090238063	090238063			OFF	10		
906	031407034	031407036			OFF	10		
906	031407034	090238068			OFF	10		
903	016201056	016202024			OFF	4		
903	016201056	016201056			OFF	4		
903	016201056	016202024			OFF	4		
903	016201056	016202024			OFF	4		
903	016201056	016201056			OFF	4		
903	016201056	016202024			OFF	4		

Record: 1 of 957

Figure 47. Sample Bridge Cost Estimate Report (Also Known as the Worktable).

Optional Step: Find Unmatched CSJs

- Select the Unmatched CSJs report type and click the Create Report button (Figure 48) to identify CSJs found in table DCIS_PROJ_INFO_STRUCT_DATA_VW but not in the bridge cost estimate table. For completeness, the Unmatched CSJ report (Figure 49), includes corresponding contract CSJs.

The screenshot shows a software window titled "BRIDGE_COST_DATA:Form". It has four tabs: "Introduction", "Bridge Reports", "Report Options", and "Export Tables". The "Report Options" tab is active. Inside the window, there is a text box with instructions: "Select a let date type (fiscal year or month range), enter the date range of interest, and click Create New Table to generate a new table that contains project estimate data for the date range selected. After creating the new table, you can generate reports. Creating the new table could take anywhere from a few seconds to a couple of minutes." Below this, there are two dropdown menus: "Let Date Type" set to "Fiscal Year" and "Fiscal Year" set to "2009". To the right of these is a "Create New Table" button. Below the text box, it says "The project estimate table is available for use." There is a "Select report type" dropdown menu set to "Unmatched CSJs", a "Create Report" button, and a "Find Next" button. A text box to the right of the "Create Report" button explains: "This option selects all CSJs found in table DCIS_PROJ_INFO_STRUCT_DATA_VW but not in table BRG_COST_EST_2009." At the bottom left, it says "Record: 1 of 1".

Figure 48. Unmatched CSJs Report Option.

The screenshot shows a window titled "v_UNMATCHED_CSJ_2009: Select Query". It displays a table with three columns: "ACTUAL_LET_DATE", "CONTROL_SECT_JOB", and "CONTRACT_CSJ". The table contains 23 rows of data. The first row is highlighted. At the bottom, it says "Record: 1 of 23".

ACTUAL_LET_DATE	CONTROL_SECT_JOB	CONTRACT_CSJ
907	035304090	035304090
811	092127027	092127027
811	092127029	092127027
906	088902014	088902014
901	020404040	020404040
901	000706075	000706075
901	255201049	255201049
906	001306039	001306039
907	019607027	019607027
908	061702058	061702058
908	237405070	237405070
905	091846217	091846065
811	092127028	092127027
901	090248537	090248537
907	009214078	009214076
907	035306055	035304090
908	226302081	061702058
904	052202028	052202028

Figure 49. Sample Unmatched CSJs Report.

Optional Step: Find Total Bridge Cost Percentages Not Adding Up to 100 Percent

- Select Total Bridge Cost Percentages Not 100 percent from the Report type menu and click the Create Report button (Figure 50) to identify CSJs and bridges for which the addition of the bridge cost percentages is not 100 percent (Figure 51).

BRIDGE_COST_DATA : Form

Introduction Bridge Reports Report Options Export Tables

Select a let date type (fiscal year or month range), enter the date range of interest, and click Create New Table to generate a new table that contains project estimate data for the date range selected. After creating the new table, you can generate reports. Creating the new table could take anywhere from a few seconds to a couple of minutes.

Let Date Type: Fiscal Year

Fiscal Year: 2009

Create New Table

The project estimate table is available for use.

Select report type: Total Bridge Cost Percentages not 100% Create Report

This option selects all CSJs for which the total bridge cost percentages do not add up to 100%.

Record: 1 of 1

Figure 50. Total Bridge Cost Percentages Not 100 Percent Report Option.

CSJ	NBI	Total Cost (%)	ACTUAL_LET_DATE
038304054	161370038304009	56.59	904
038304054	161370038304010	43.41	904
039804067	090140039804029	50	904
039804067	090140039804040	50	904
053506041	130760053506101	50	901
053506041	130760053506102	50	901
053507045	130760053507045	11.83	901
053507045	130760053507046	10.75	901
053507045	130760053507070	12.77	901
053507045	130760053507071	11.68	901
053507045	130760053507073	7.93	901
053507045	130760053507074	6.51	901
053507045	130760053507075	12.7	901
053507045	130760053507076	12.47	901
053507045	130760053507078	7.39	901
053507045	130760053507079	5.97	901

Record: 1 of 67

Figure 51. Total Bridge Cost Percentages Not 100 Percent Report.

Optional Step: Find Total Project Cost Percentages Not Adding Up to 100 Percent

- Select Total Project Cost Percentages Not 100 Percent from the Report type menu and click the Create Reports button (Figure 52) to identify CSJs for which the addition of the project cost percentages is not 100 percent (Figure 53).

BRIDGE_COST_DATA:Form

Introduction Bridge Reports Report Options Export Tables

Select a let date type (fiscal year or month range), enter the date range of interest, and click Create New Table to generate a new table that contains project estimate data for the date range selected. After creating the new table, you can generate reports. Creating the new table could take anywhere from a few seconds to a couple of minutes.

Let Date Type Fiscal Year

Fiscal Year 2009

Create New Table

The project estimate table is available for use.

Select report type Total Project Cost Percentages not 100% Create Report

This option selects all CSJs for which the total project cost percentages do not add up to 100%.

Record: 1 of 1

Figure 52. Total Project Cost Percentages Not 100 Percent Report Option.

CONTROL_SECT_JOB	TOTAL_PROJ_COST
000912073	200
007503019	300
008302046	200
008805086	200
013705028	500
029903047	200
051704050	300
310601012	200
325602076	200
009104041	400
023103125	400
025504072	200
054504033	200
120101012	200

Record: 1 of 82

Figure 53. Total Project Cost Percentages Not 100 Percent Report.

Optional Step: Export Tables

- Click the Export Tables tab, click the Retrieve Database Tables button, select the table(s) of interest from the pull-down list. Next, click the Export Data button to export the selected table(s) to the DATA_EXPORT.mdb Access database file (Figure 54). By default, the destination database file is located in the D:\0-6389-P1\ Bridge_Cost_Estimate\Export\ folder.

The screenshot shows a software window titled "BRIDGE_COST_DATA: Form". It has four tabs: "Introduction", "Bridge Reports", "Report Options", and "Export Tables", with the "Export Tables" tab currently selected. Inside the window, there is a text box that reads: "Click Retrieve Database Tables, select a table from the dropdown list, and click Export Data to export the table to a separate database called DATA_EXPORT.mdb located at D:\0-6389\Bridge_Cost_Estimate\EXPORT\." Below this text box, there is a button labeled "Retrieve Database Tables" and a dropdown menu showing "BRG_COST_REPORT_2009". Below the dropdown menu is a button labeled "Export Data". At the bottom of the window, there is a status bar that says "Record: 1 of 1" with navigation icons.

Figure 54. Export Tables Tab.

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APPENDIX A. PROTOTYPE BRIDGE STATISTICS DATABASE QUERIES

The summary bridge statistics prototype database application includes 161 queries (Figure 10). Of these queries, 18 queries are main queries that are activated through the application interface and the rest are sub-queries that generate partial results for use by corresponding main queries. This appendix includes a diagram for each of the following main queries showing its structure, data elements extracted, and the sub-queries it uses (Note: In the diagram, original data fields from TxDOT data systems are not defined and repeating data fields are only defined once):

- **Appendix_B_OnSys_Bridge_Condition** (Figure 55). This query generates Appendix B Condition of On-System Bridges by TxDOT District and County as of September 2008, which lists on-system bridges grouped by county, district, and bridge condition. The query uses data from three tables: TXDOT_DISTRICT, TX_COUNTY, and BrgOnYear2Brins.
- **Appendix_C_OffSys_Bridge_Condition** (Figure 56). This query generates Appendix C Condition of Off-System Bridges by TxDOT District and County as of September 2008, which lists off-system bridges grouped by county, district, and bridge condition. This query uses data from three tables: TXDOT_DISTRICT, TX_COUNTY, and BrgOffYear2Brins.
- **Figure_2_3_Timber_Bridge** (Figure 57). This query generates Figure 2-3 On-System Timber Bridges by Year, which shows the number of on-system timber bridges in each of the selected five previous years. The query uses data from the following tables: TIMBER_BRG_YR1, TIMBER_BRG_YR2, TIMBER_BRG_YR3, TIMBER_BRG_YR4, and TIMBER_BRG_YR5.
- **Figure_3_2_Bridge_Condition_Change** (Figure 58). This query generates Figure 3-2 Change in Condition of Non-Sufficient Bridges from FY2006 through FY2008, which shows the change of structurally deficient, functionally obsolete, and substandard for load only bridges in the study year compared with the bridges two years ago. The query uses data from four tables: BrgOnYear1Brins, BrgOffYear1Brins, BrgOnYear2Brins, and BrgOffYear2Brins.
- **Table_2_1_Bridge_Count** (Figure 59). This query generates Table 2-1 Count of On- and Off- System Bridges, which compares the numbers of on- and off-system bridges between fiscal year 2006 and 2008. The query uses data from four tables: BrgOnYear1Brins, BrgOffYear1Brins, BrgOnYear2Brins, and BrgOffYear2Brins.
- **Table_2_2_Bridge_Age_Distribution** (Figure 60). This query uses data from the BrgOnYear2Brins and BrgOffYear2Brins tables to generate Table 2-2 Age of Bridges in FY2008, which lists the numbers and percentages of bridges that were built before 1950, 1950–1970, or after 1970.

- **Table 2_3 Bridge Age Change** (Figure 61). This query generates Table 2-3 Change in Age of Bridges from September 2006 to September 2008, which compares the numbers of on- and off- system bridges that were built before 1950, 1950–1970, or after 1970 between the study fiscal year (e.g., 2008) and an earlier year (e.g., 2006). The query uses BRINSAP data from four tables: BrgOnYear1Brins, BrgOffYear1Brins, BrgOnYear2Brins, and BrgOffYear2Brins.
- **Table 3_1 Condition Of Bridges** (Figure 62). This query generates Table 3-1 Condition of Texas Bridges by Count in September 2008, which shows the numbers and percentages of on- and off- system bridges in different conditions (i.e., sufficient, structurally deficient, functionally obsolete, and not classified by condition). The query uses data from the BrgOnYear2Brins and BrgOffYear2Brins tables.
- **Table 3_2 Load Posted Closed** (Figure 63). This query generates Table 3-2 Load Posted and Closed Bridges as of September 2008 based on data from the BrgOnYear2Brins, BrgOffYear2Brins, and TXDOT_DISTRICT tables. Table 3-2 contains a list of on- and off- system bridges grouped by district and load conditions (i.e., load-posted, closed, and recommended for load posting or closure).
- **Table 5_1 OnSys HBP Bridges** (Figure 64). This query generates Table 5-1 On-System Bridges Awarded in HBP Projects, by District, which is a list of bridges in HBP projects by district in the study year (e.g., 2008) as well as an earlier year (e.g., 2006) for comparison purposes. The query uses data from the following tables: dbo_DCIS_PROJ_EST_BRDG_VW, dbo_DCIS_PROJECT_INFORMATION_VW, dbo_DCIS_PROJ_INFO_WORK_PGM_VW, and TXDOT_DISTRICT.
- **Table 5_2 OnSys NHBP Bridges** (Figure 65). This query generates Table 5-2 On-System Bridges Awarded in Non-HBP Projects, by Districts, which list the new location and replacement/rehabilitation bridges in non-HBP projects by districts for the study fiscal year (2008) as well as an earlier year (e.g., 2006) for comparison purposes. The query uses data from tables used to generate Table 5_1 OnSys HBP Bridges.
- **Table 5_3 OnSys Bridges** (Figure 66). This query generates Table 5-3 On-System Bridges Replaced or Rehabilitated in FY 2008, which is a list of bridges grouped by funding type (HBP funded versus non-HBP funded) and bridge condition (i.e., structurally deficient, functionally obsolete, and not structurally deficient or functionally obsolete). This query uses DCIS and BRINSAP data from the following tables: dbo_DCIS_PROJ_EST_BRDG_VW, dbo_DCIS_PROJECT_INFORMATION_VW, dbo_DCIS_PROJ_INFO_WORK_PGM_VW, dbo_DCIS_PROJ_INFO_STRUCT_DATA_VW, and BrgOnYear2Brins.
- **Table 5_4 OnSys Bridge Projects** (Figure 67). This query generates Table 5-4 On-System Bridges in Bridge Projects Awarded in FY 2008, which lists the numbers of HBP-funded replacement/rehabilitation projects, non-HBP replacement/rehabilitation projects, and non-HBP new location projects in the study fiscal year (e.g., 2008) and their total funds and numbers of bridges involved. The query extracts data from the following

tables: BRG_COST_ESTIMATE_Y2, dbo_DCIS_PROJ_EST_BRDG_VW, dbo_DCIS_PROJECT_INFORMATION_VW, and dbo_DCIS_PROJ_INFO_WORK_PGM_VW.

- **_Table_6_1_OffSys_HBP_Bridges** (Figure 68). This query generates Table 6-1 Off-System Bridges Awarded in HBP Projects, by District, which lists the number of bridges for each district that were in HBP projects in the study fiscal year (e.g., 2008) as well as an earlier year (e.g., 2006) for comparison purposes. The query uses data from tables used to generate _Table_5_1_OnSys_HBP_Bridges.
- **_Table_6_2_OffSys_NHBP_Bridges** (Figure 69). This query generates Table 6-2 Off-System Bridges Awarded in Non-HBP Projects, by District, which lists the number of off-system bridges in non-HBP projects by districts for the study fiscal year (e.g., 2008) as well as an earlier year (e.g., 2006) for comparison purposes. The query uses data from tables used to generate _Table_5_1_OnSys_HBP_Bridges.
- **_Table_6_3_OffSys_Bridges** (Figure 70). This query summarizes the numbers of off-system bridges in HBP and non-HBP funded projects that were structurally deficient, functionally obsolete, or not structurally deficient or functionally obsolete, respectively. The query extracts data from the following tables: dbo_DCIS_PROJ_EST_BRDG_VW, dbo_DCIS_PROJECT_INFORMATION_VW, dbo_DCIS_PROJ_INFO_WORK_PGM_VW, dbo_DCIS_PROJ_INFO_STRUCT_DATA_VW, and BrgOffYear2Brins.
- **_Table_6_4_OffSys_Bridge_Projects** (Figure 71). This query generates Table 6-4 Off-System Bridges in Projects Awarded in FY 2008, which lists numbers of HBP projects, non-HBP replacement/rehabilitation projects, and non-HBP new-location projects, and the total funds and number of bridges associated with those projects. The query uses data from tables used to generate _Table_5_4_OnSys_Bridge_Projects.
- **_Table_7_1_80_Percent_Improvement_Goal** (Figure 72). This query generates Table 7-1 Bridges that Must Be Improved to Reach the 80%-Sufficient-by-End-Of-2010 Goal, which includes the current bridge inventory number, 80 percent of current bridge inventory number, the number of currently sufficient bridges, the number of additional bridges to be improved over three years, and the average number of bridges to be improved per year. This query extracts data from two tables: BrgOnYear2Brins and BrgOffYear2Brins.

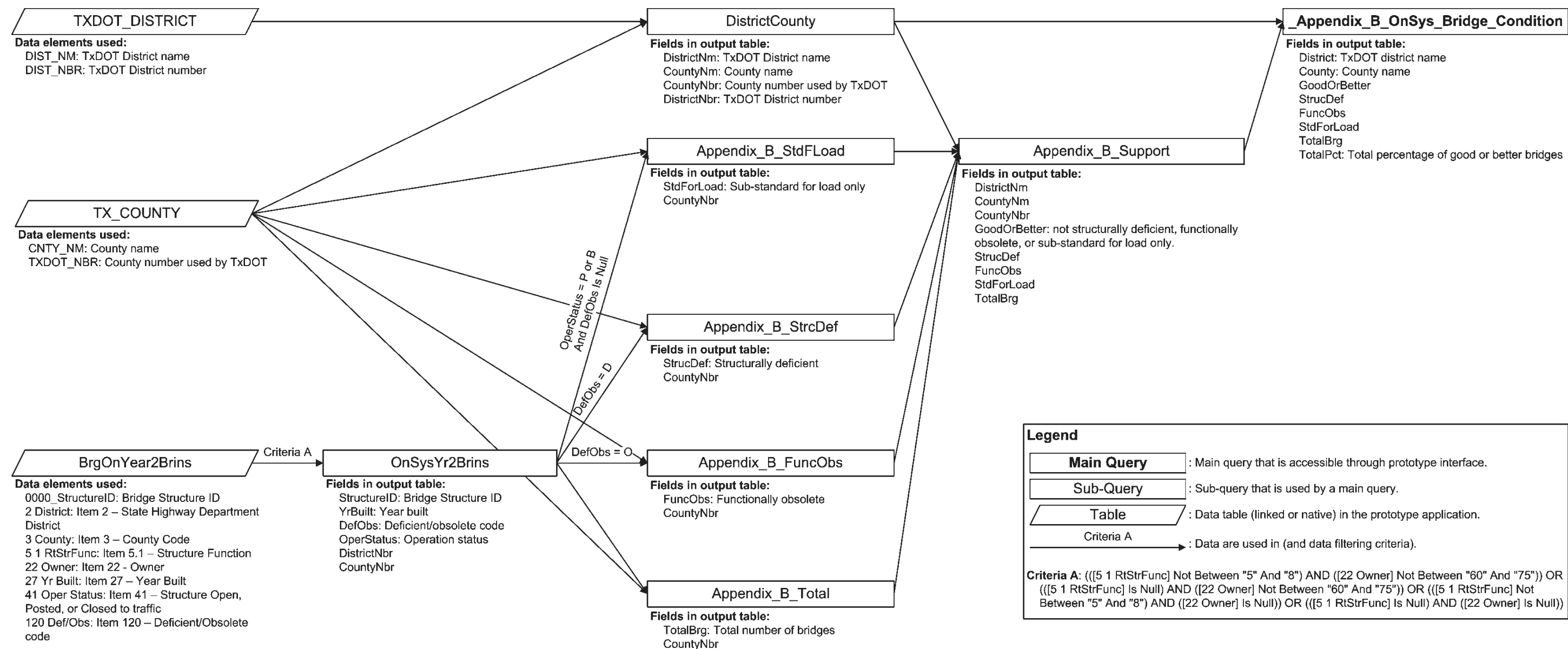


Figure 55. Structure of the _Appendix_B_OnSys_Bridge_Condition Query.

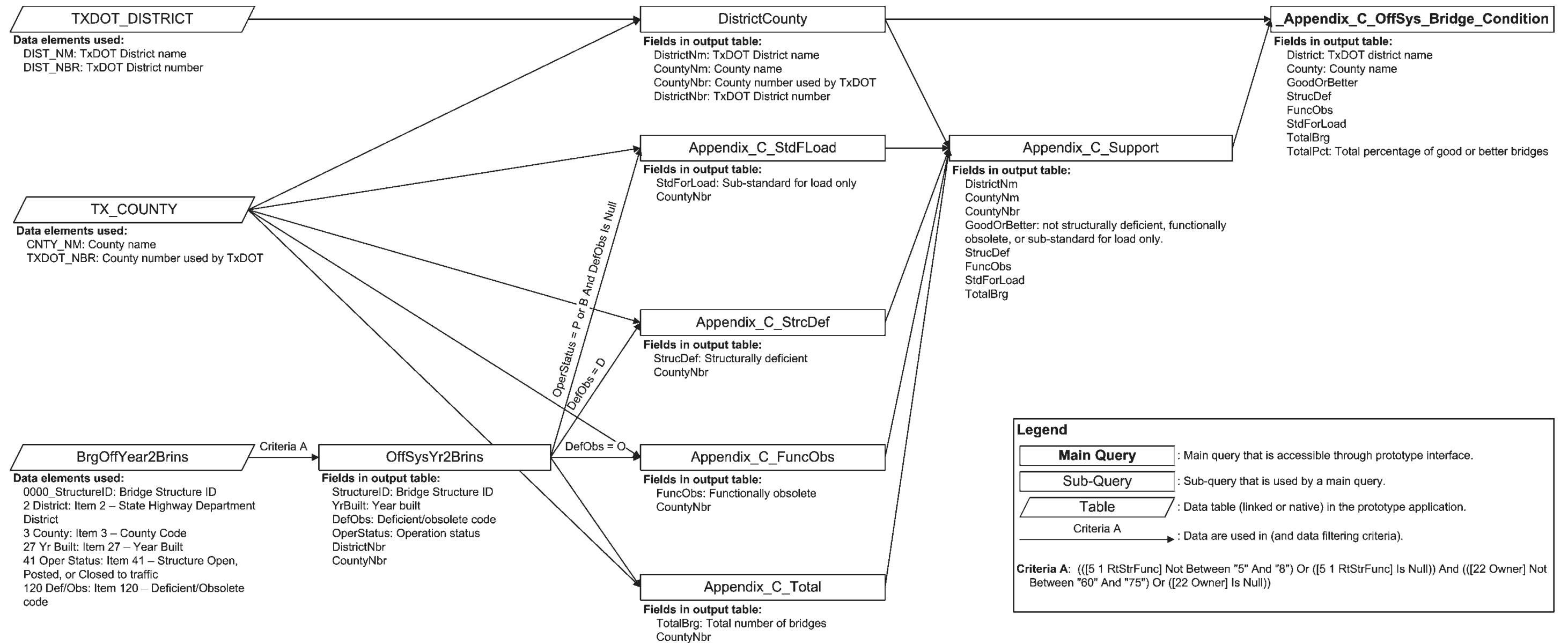


Figure 56. Structure of the _Appendix_C_OffSys_Bridge_Condition Query.

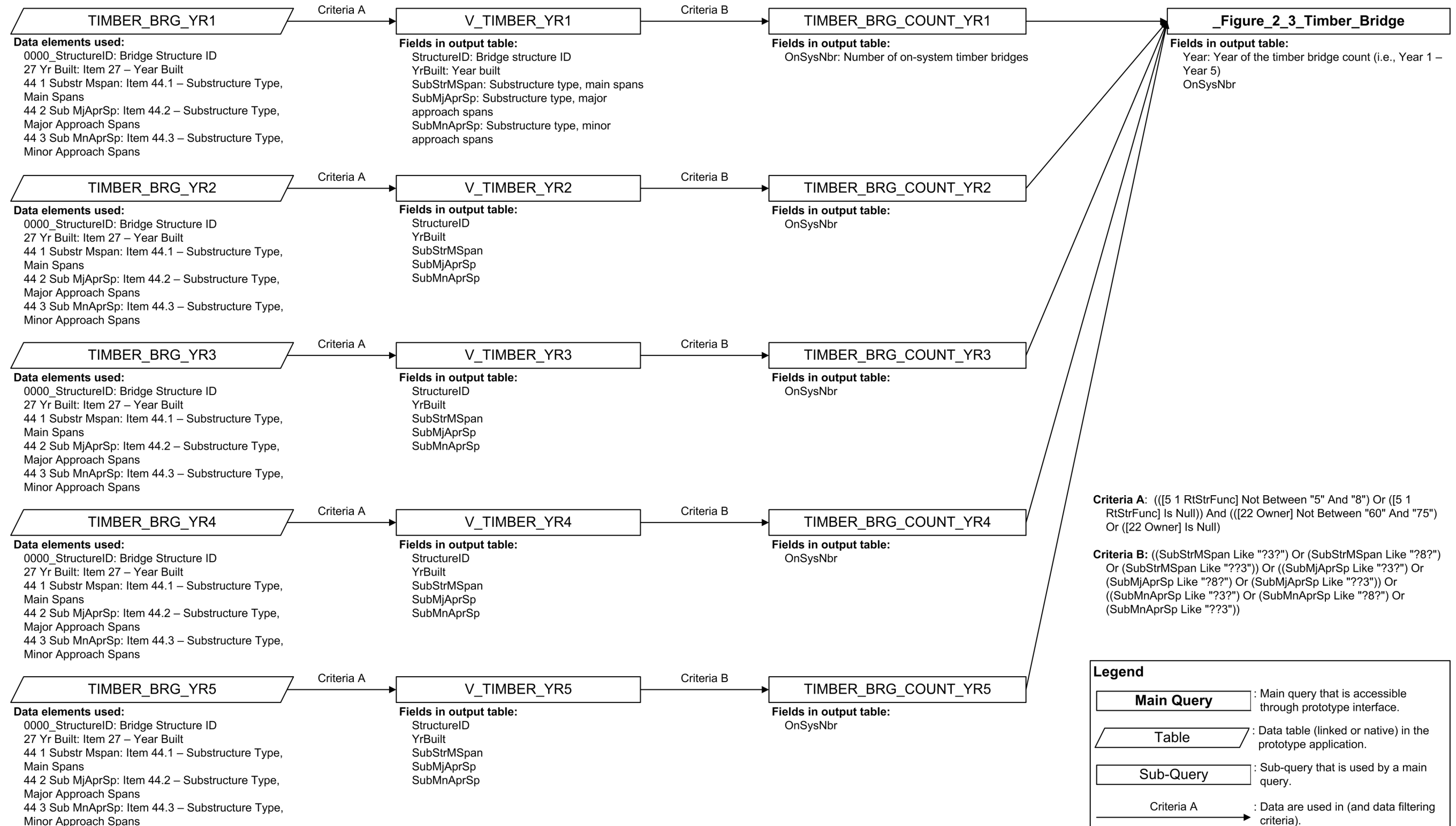


Figure 57. Structure of the _Figure_2_3_Timber_Bridge Query.

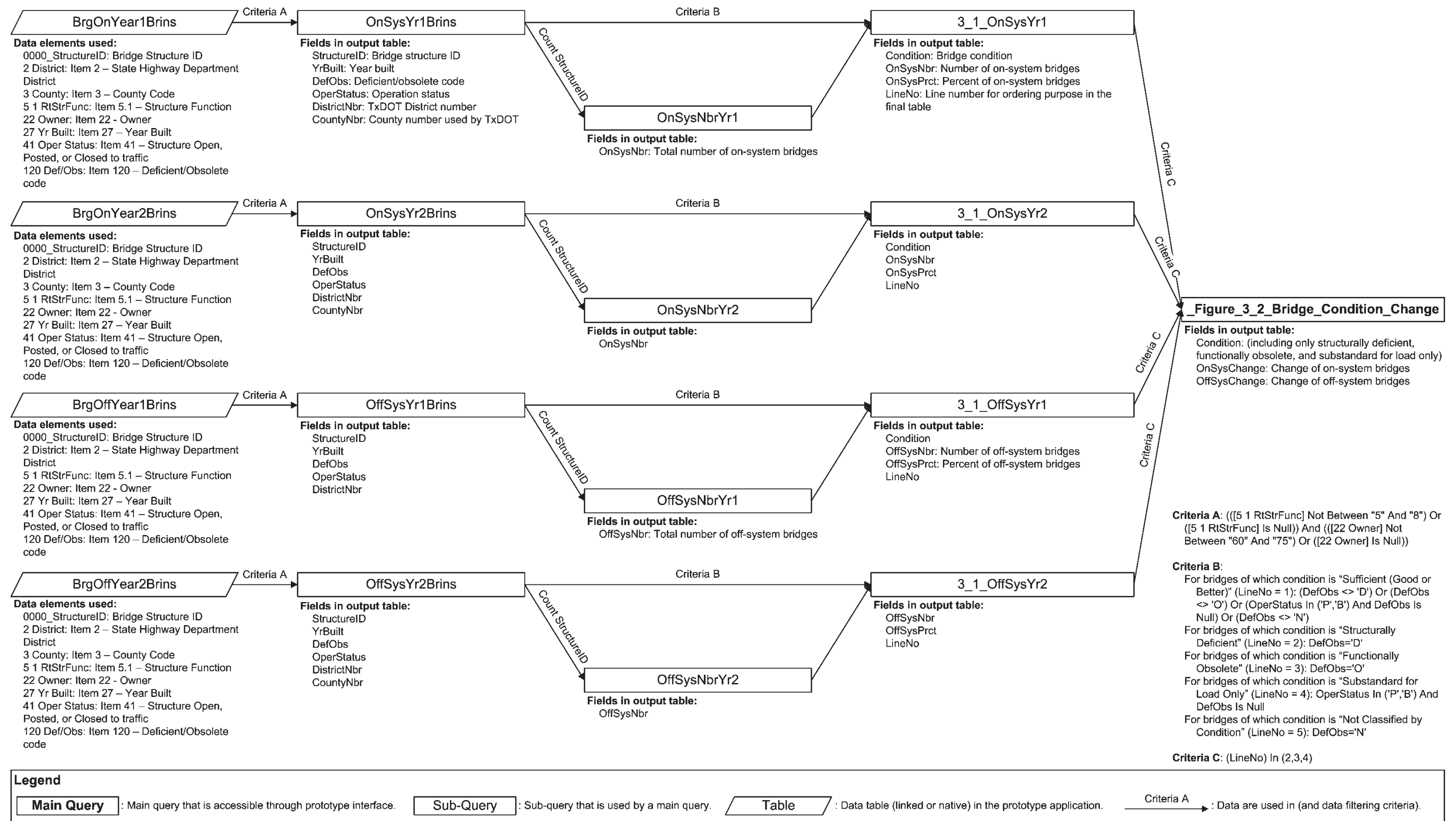


Figure 58. Structure of the Figure 3.2 Bridge Condition Change Query.

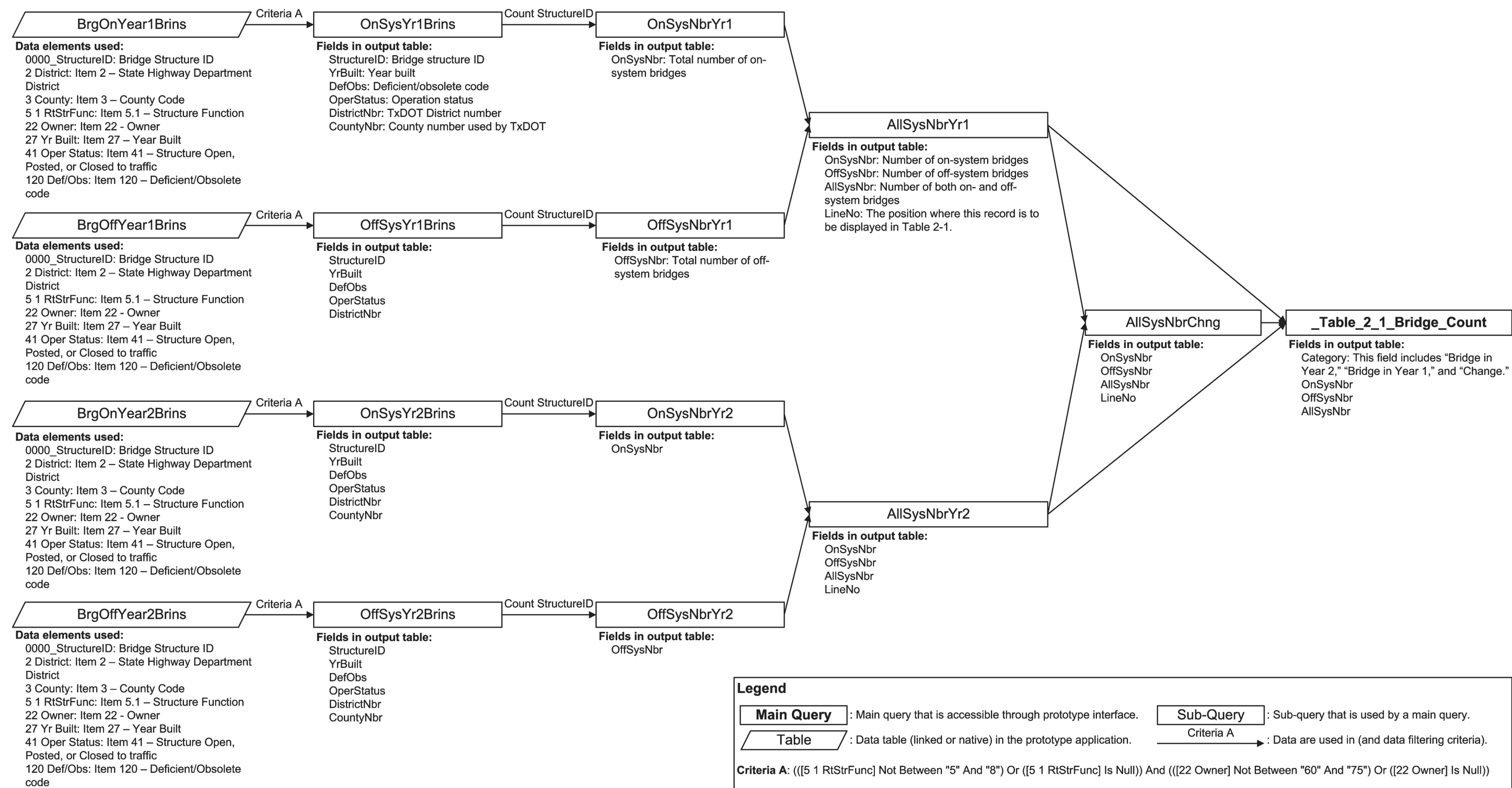


Figure 59. Structure of the _Table_2_1_Bridge_Count Query.

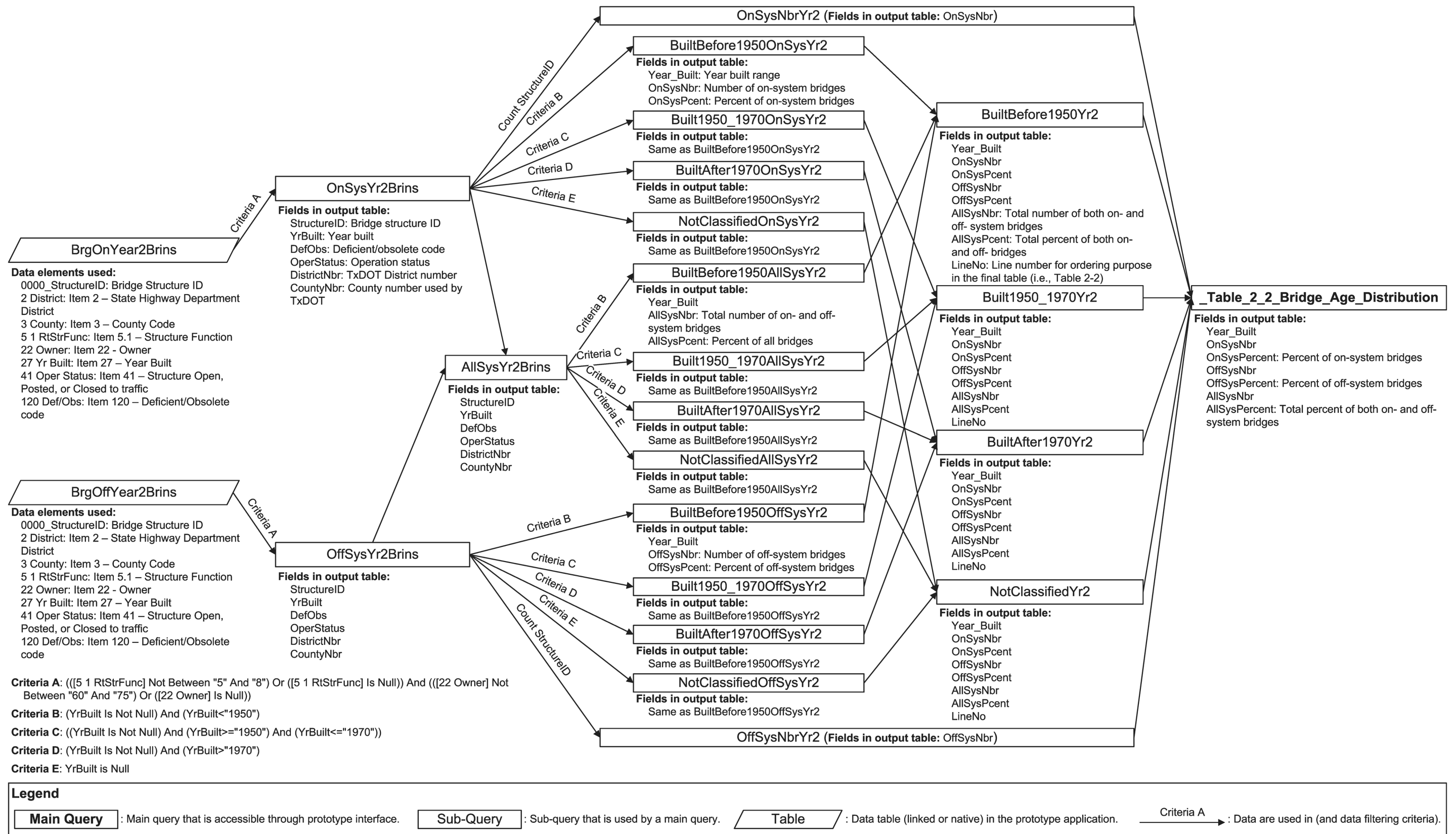


Figure 60. Structure of the _Table_2_2_Bridge_Age_Distribution Query.

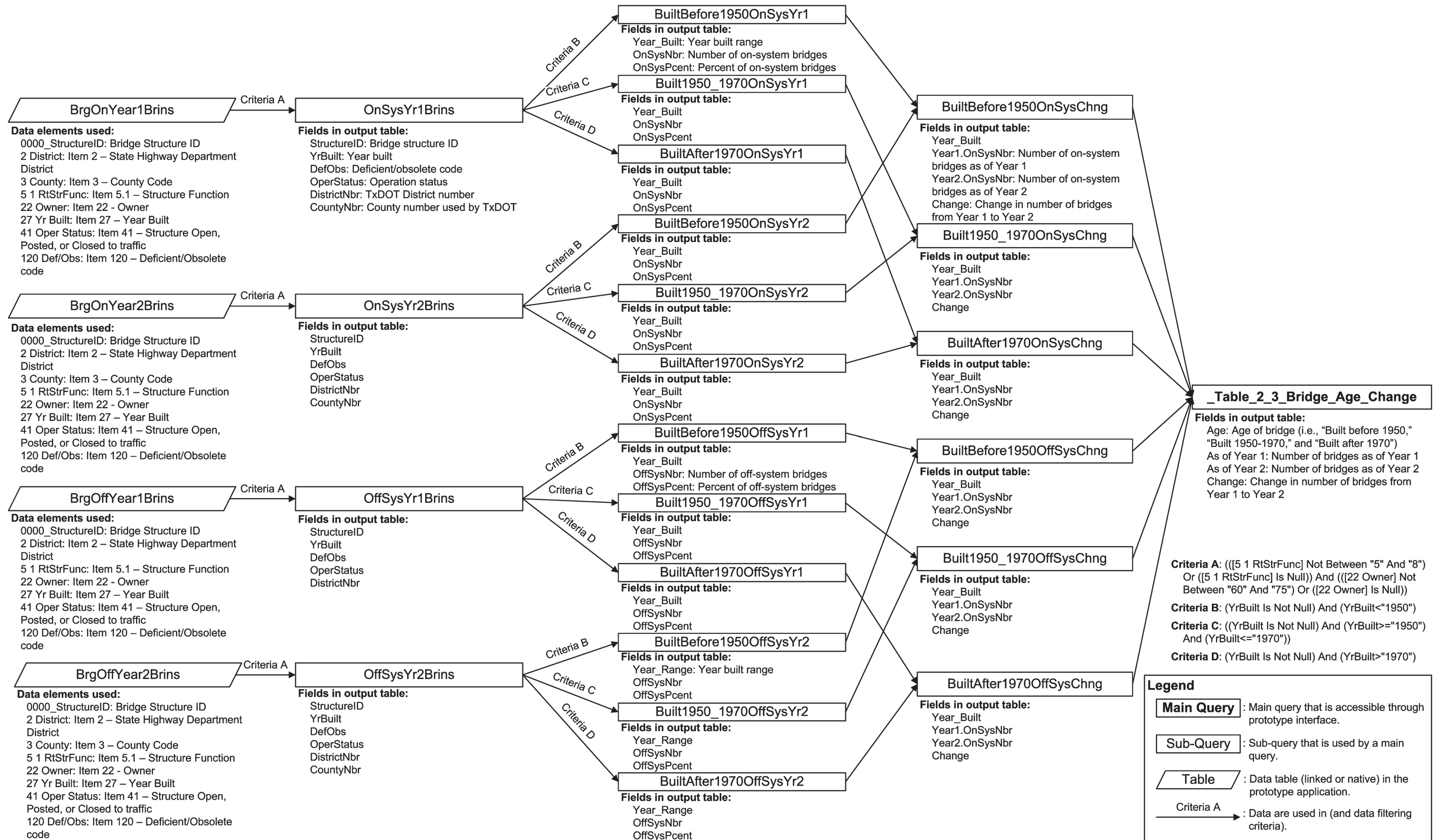


Figure 61. Structure of the _Table_2_3_Bridge_Age_Change Query.

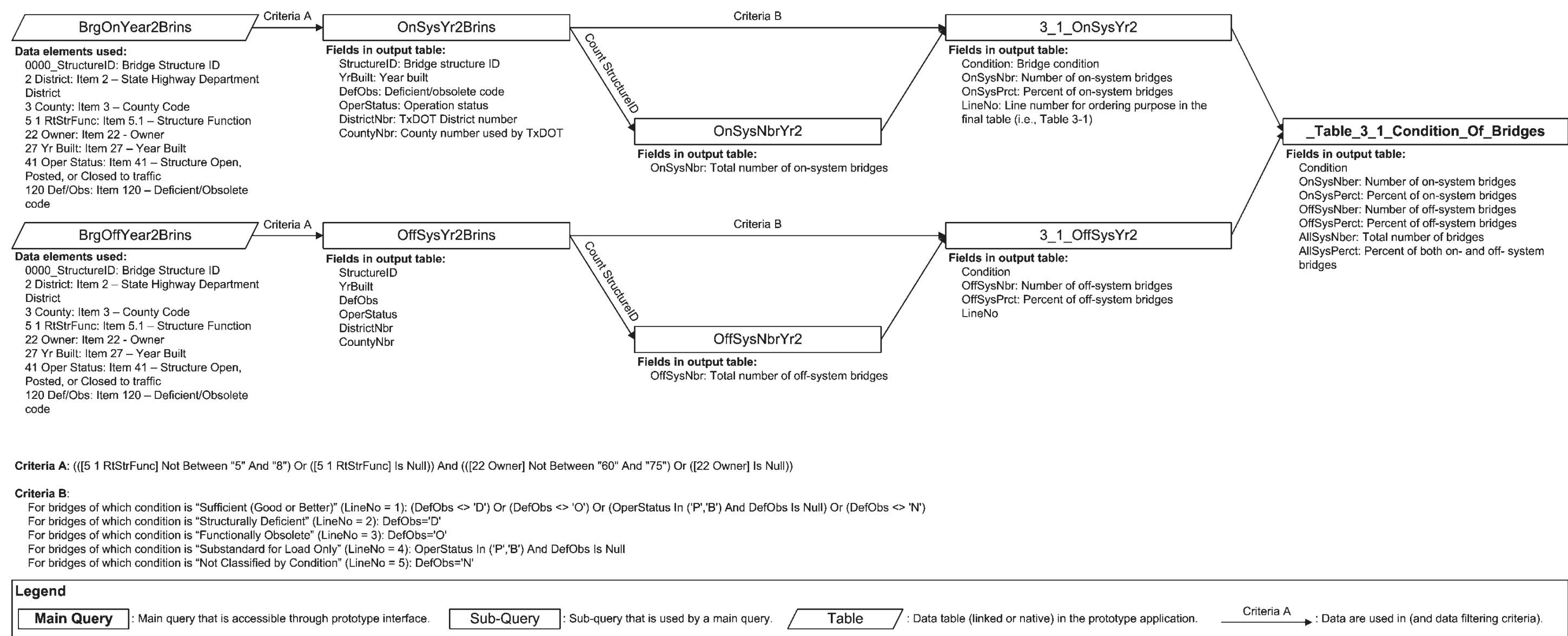


Figure 62. Structure of the _Table_3_1_Condition_Of_Bridges Query.

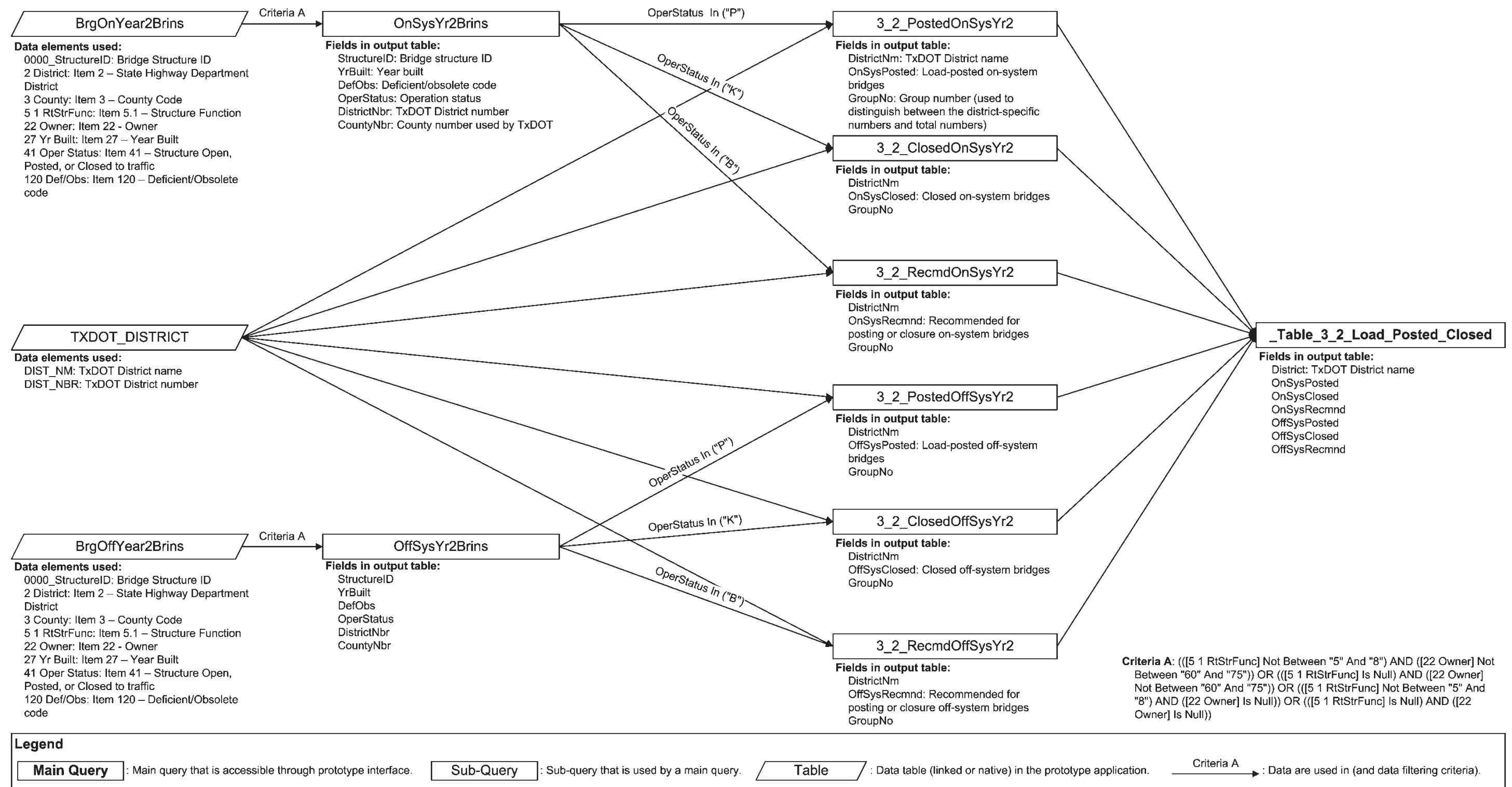


Figure 63. Structure of the _Table_3_2_Load_Posted_Closed Query.

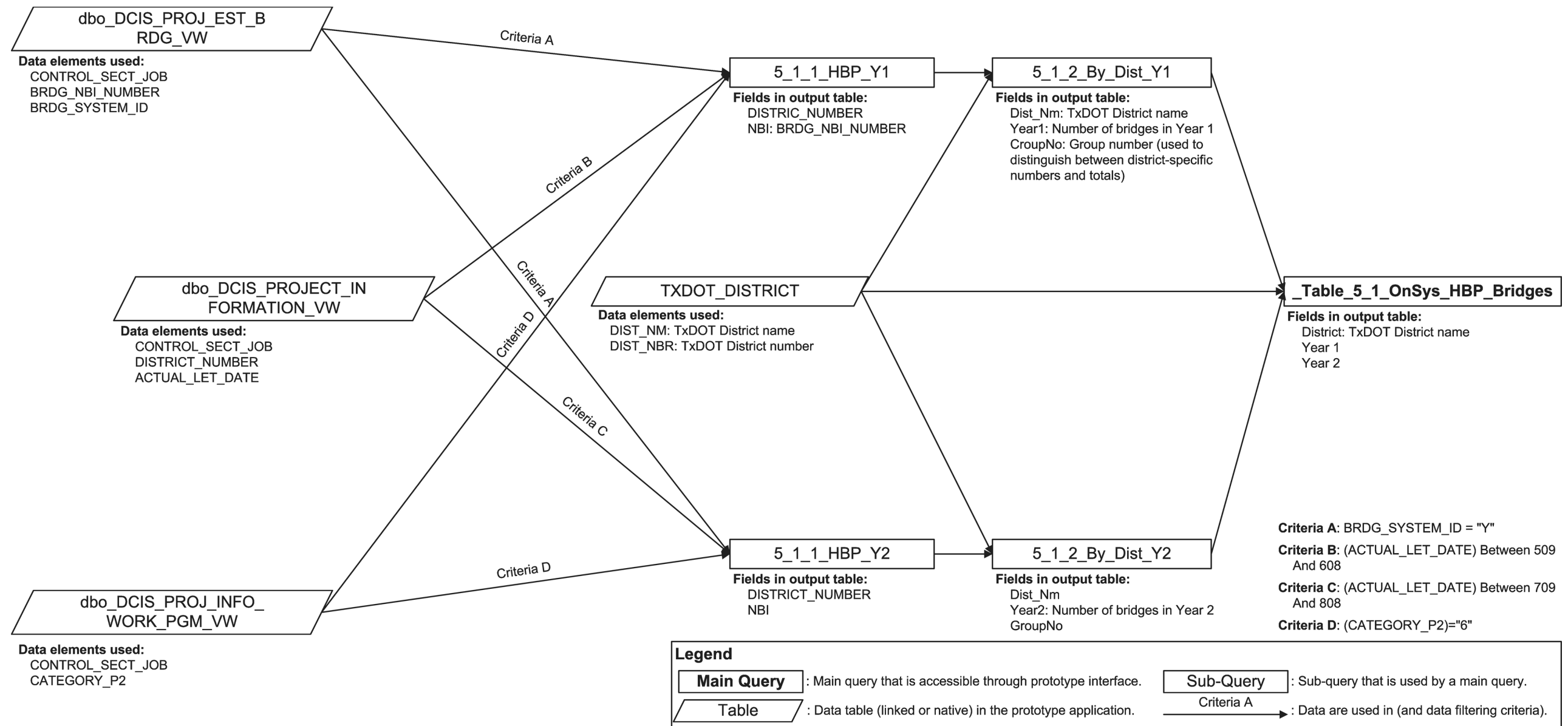


Figure 64. Structure of the _Table_5_1_OnSys_HBP_Bridges Query.

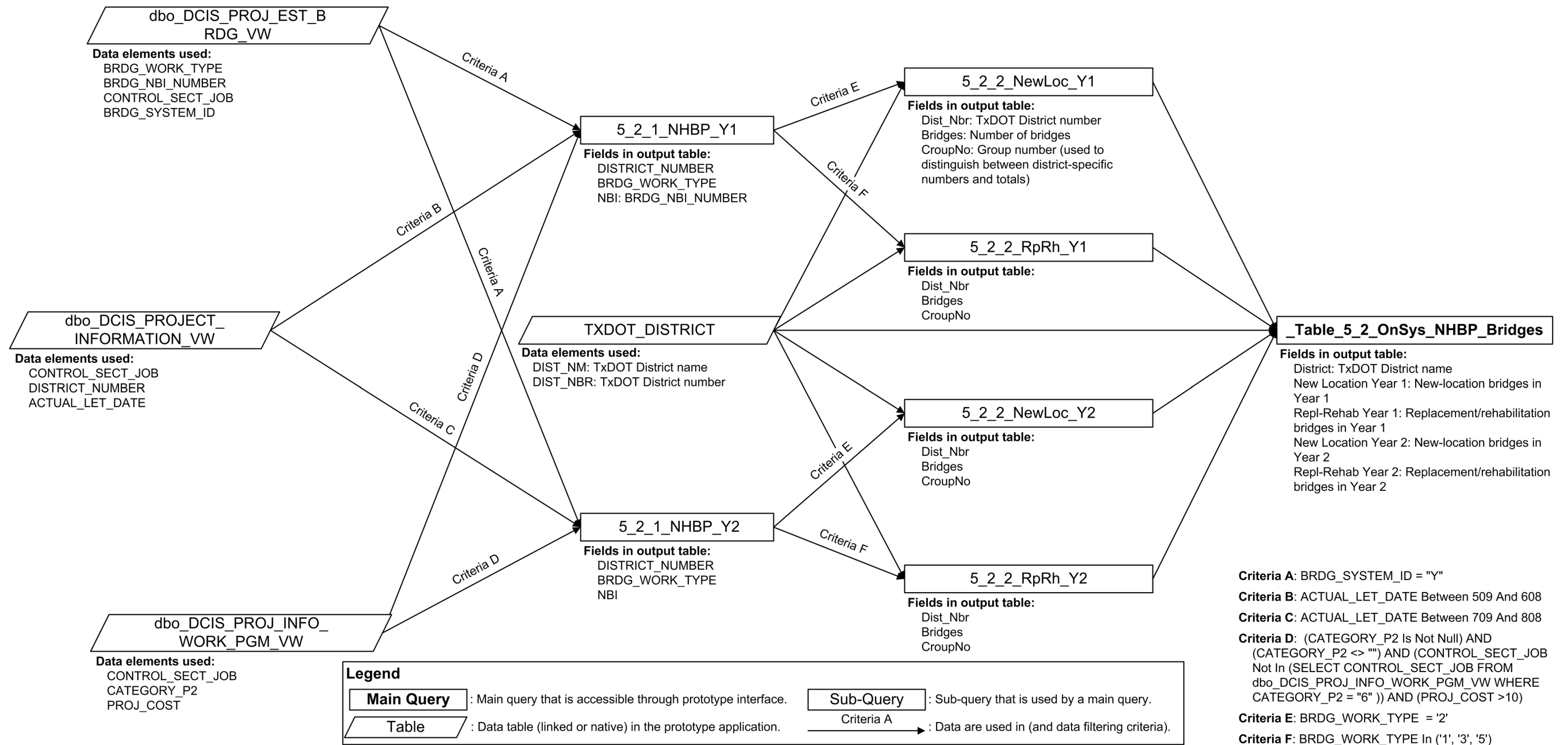


Figure 65. Structure of the _Table_5_2_OnSys_NHBP_Bridges Query.

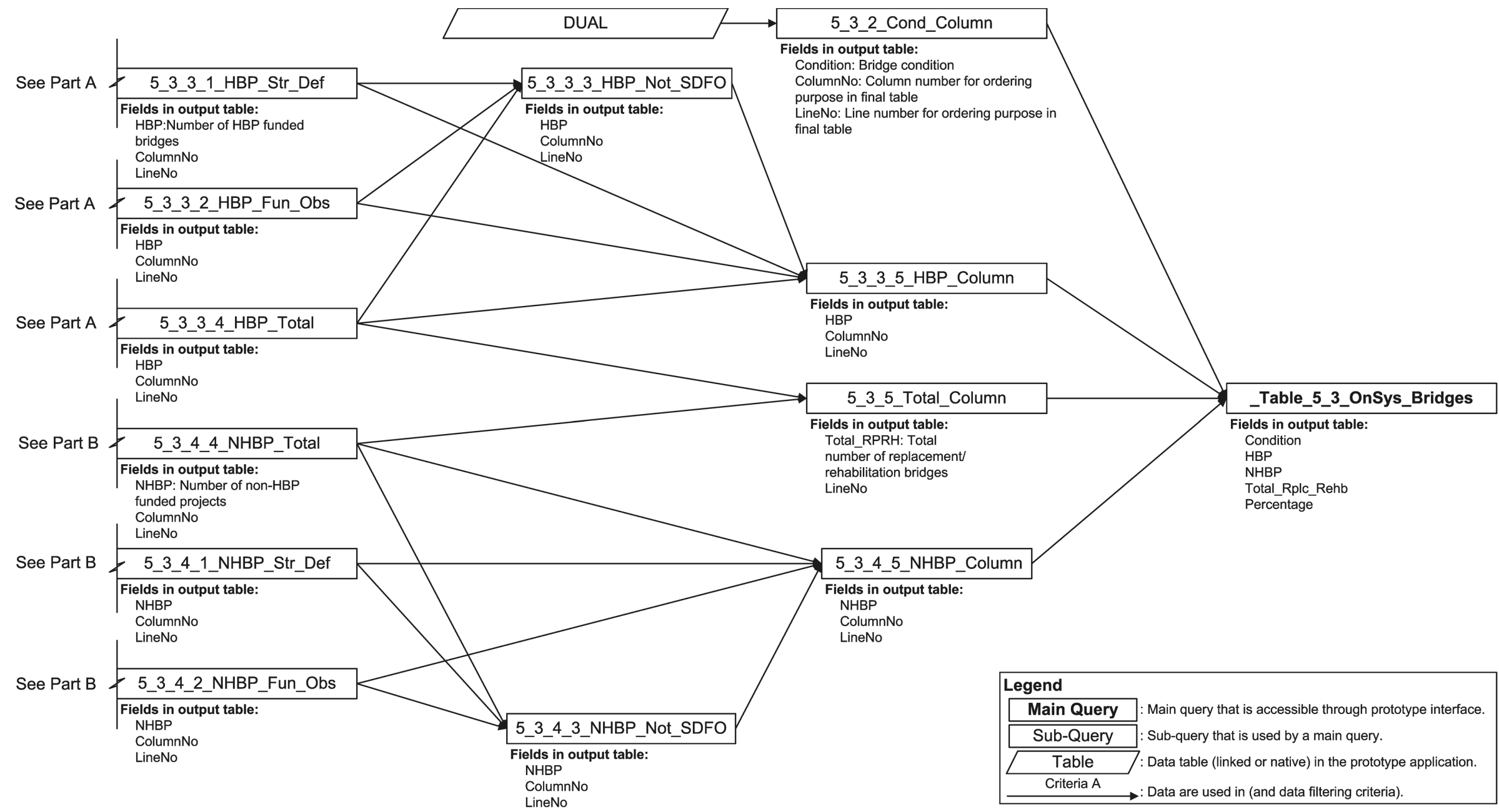


Figure 66. Structure of the _Table_5_3_OnSys_Bridges Query.

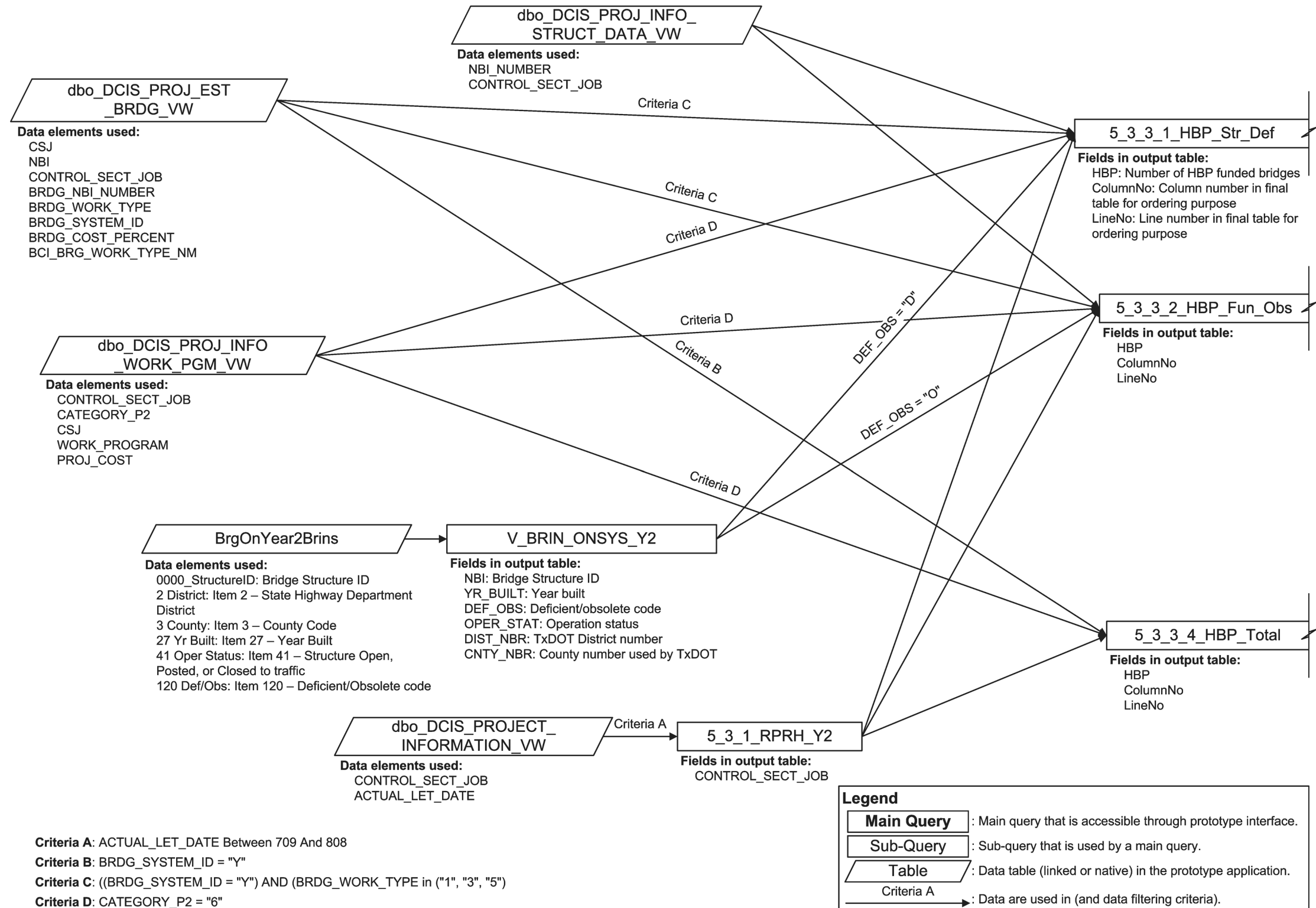


Figure 66. Structure of the Table 5_3_OnSys_Bridges Query (Continued: Part A).

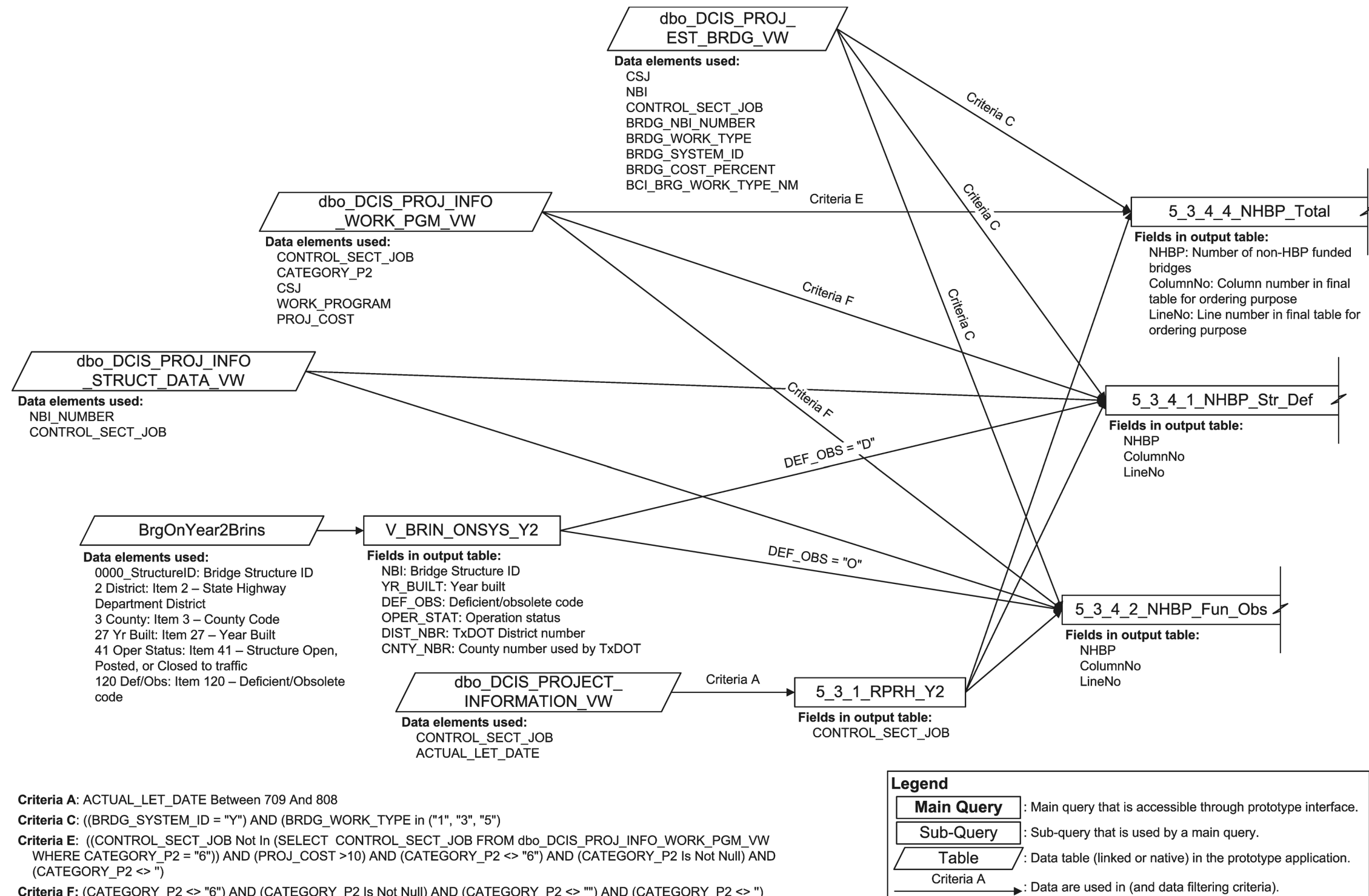


Figure 66. Structure of the Table_5_3_OnSys_Bridges Query (Continued: Part B).

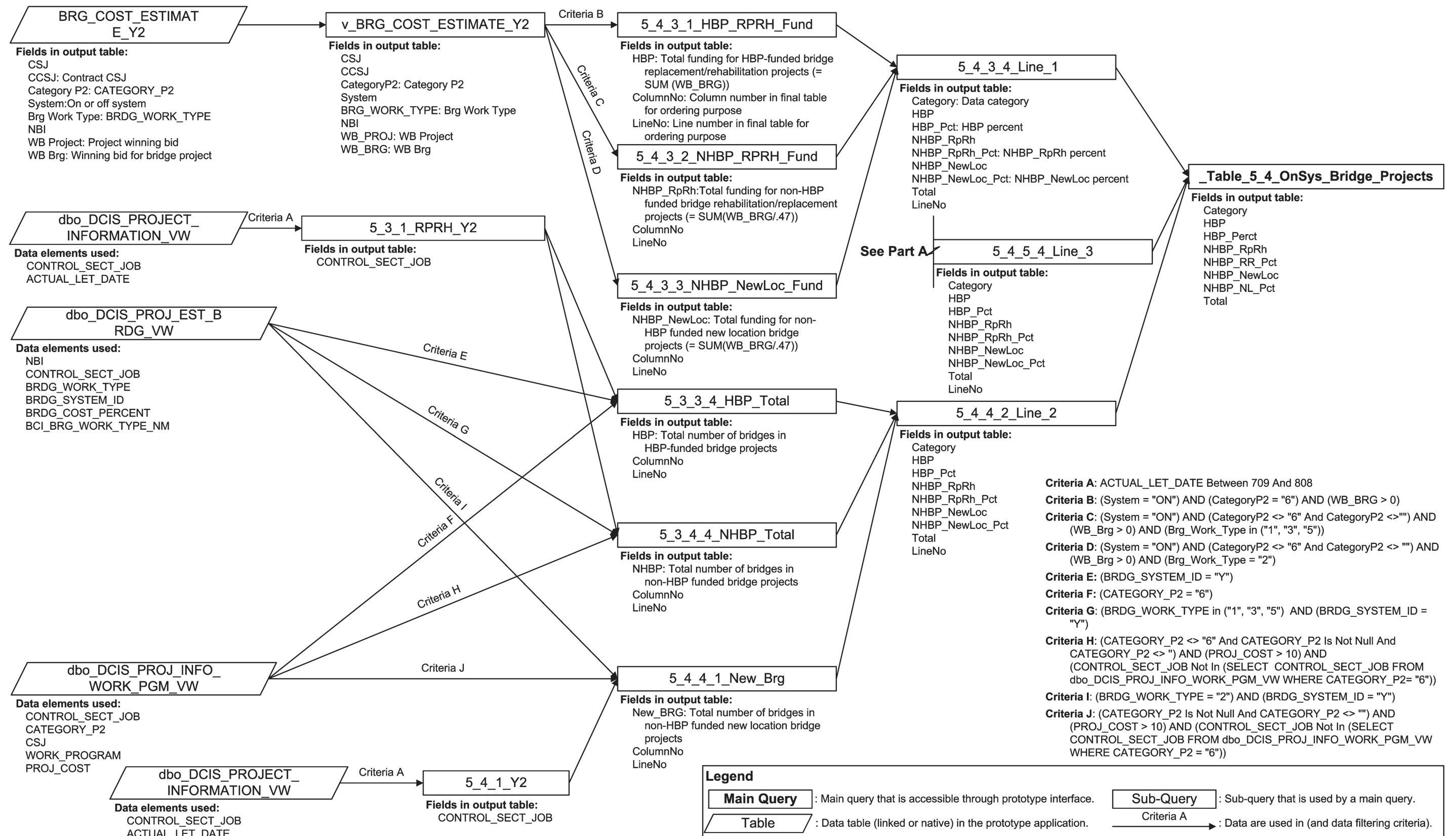
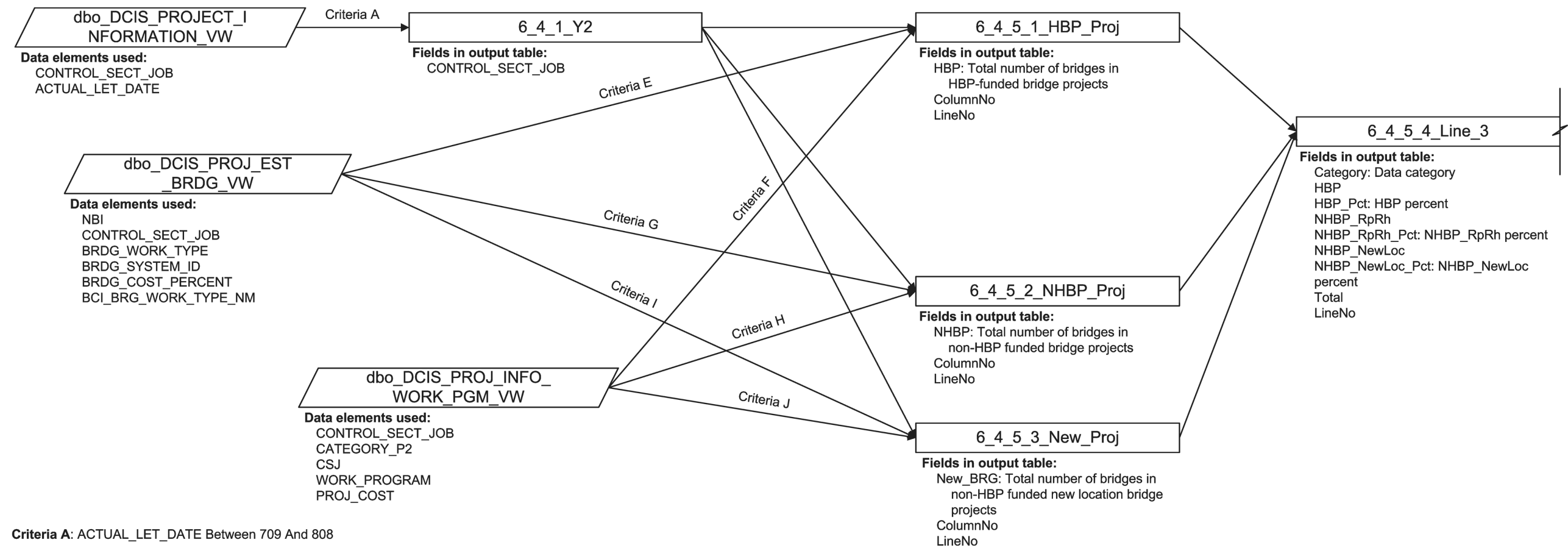


Figure 67. Structure of the _Table_5_4_OnSys_Bridge_Projects Query.



Criteria A: ACTUAL_LET_DATE Between 709 And 808

Criteria E: (BRDG_SYSTEM_ID = "N")

Criteria F: (CATEGORY_P2 = "6")

Criteria G: (BRDG_WORK_TYPE in ("1", "3", "5") AND (BRDG_SYSTEM_ID = "N"))

Criteria H: (CATEGORY_P2 <> "6" And CATEGORY_P2 Is Not Null And CATEGORY_P2 <> ") AND (PROJ_COST > 10) AND (CONTROL_SECT_JOB Not In (SELECT CONTROL_SECT_JOB FROM dbo_DCIS_PROJ_INFO_WORK_PGM_VW WHERE CATEGORY_P2= "6"))

Criteria I: (BRDG_WORK_TYPE = "2") AND (BRDG_SYSTEM_ID = "N")

Criteria J: (CATEGORY_P2 Is Not Null And CATEGORY_P2 <> "") AND (PROJ_COST > 10) AND (CONTROL_SECT_JOB Not In (SELECT CONTROL_SECT_JOB FROM dbo_DCIS_PROJ_INFO_WORK_PGM_VW WHERE CATEGORY_P2 = "6"))

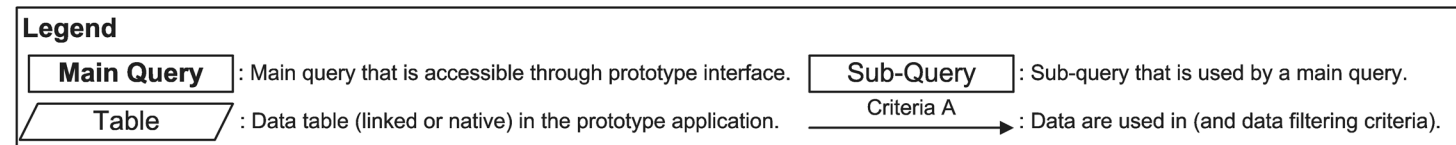


Figure 67. Structure of the _Table_5_4_OnSys_Bridge_Projects Query (Continued: Part A).

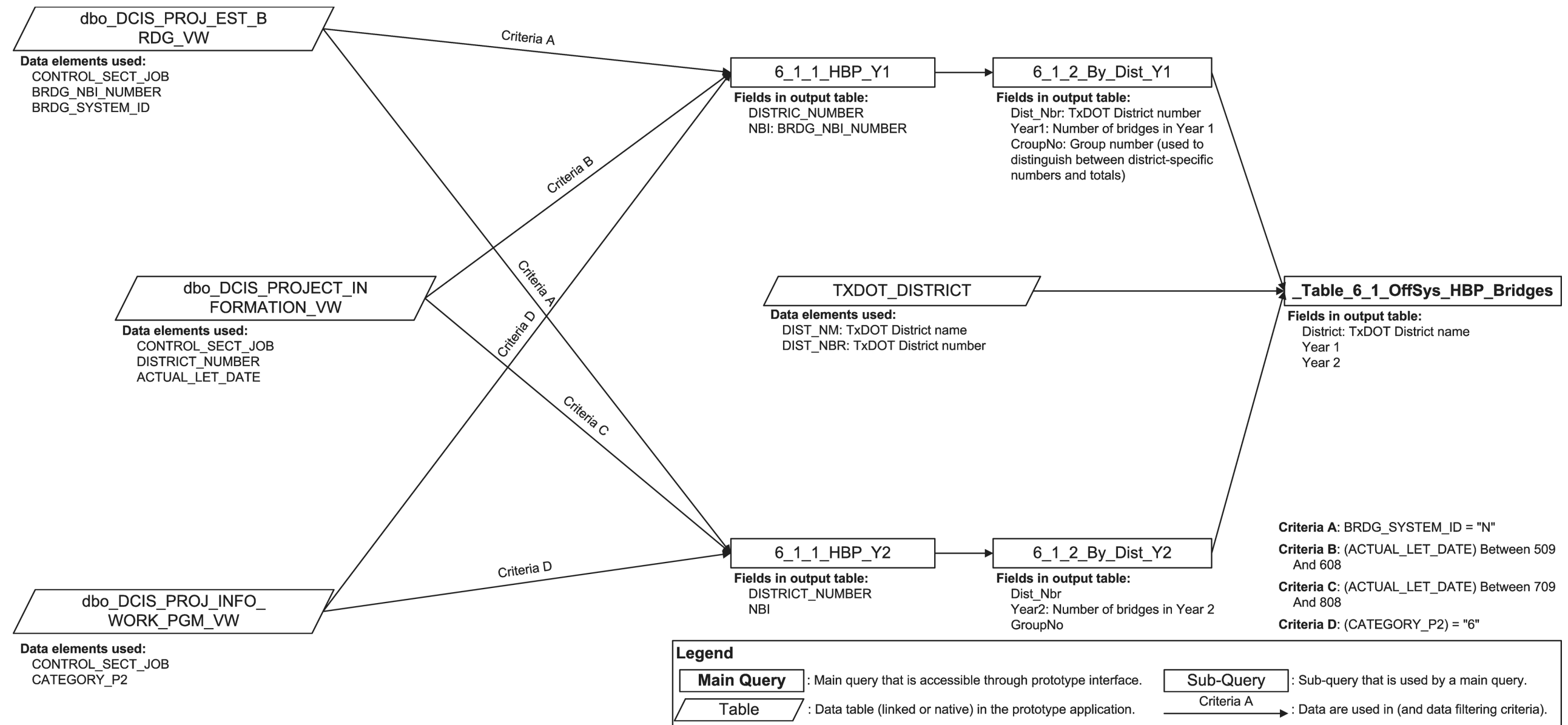


Figure 68. Structure of the _Table_6_1_OffSys_HBP_Bridges Query.

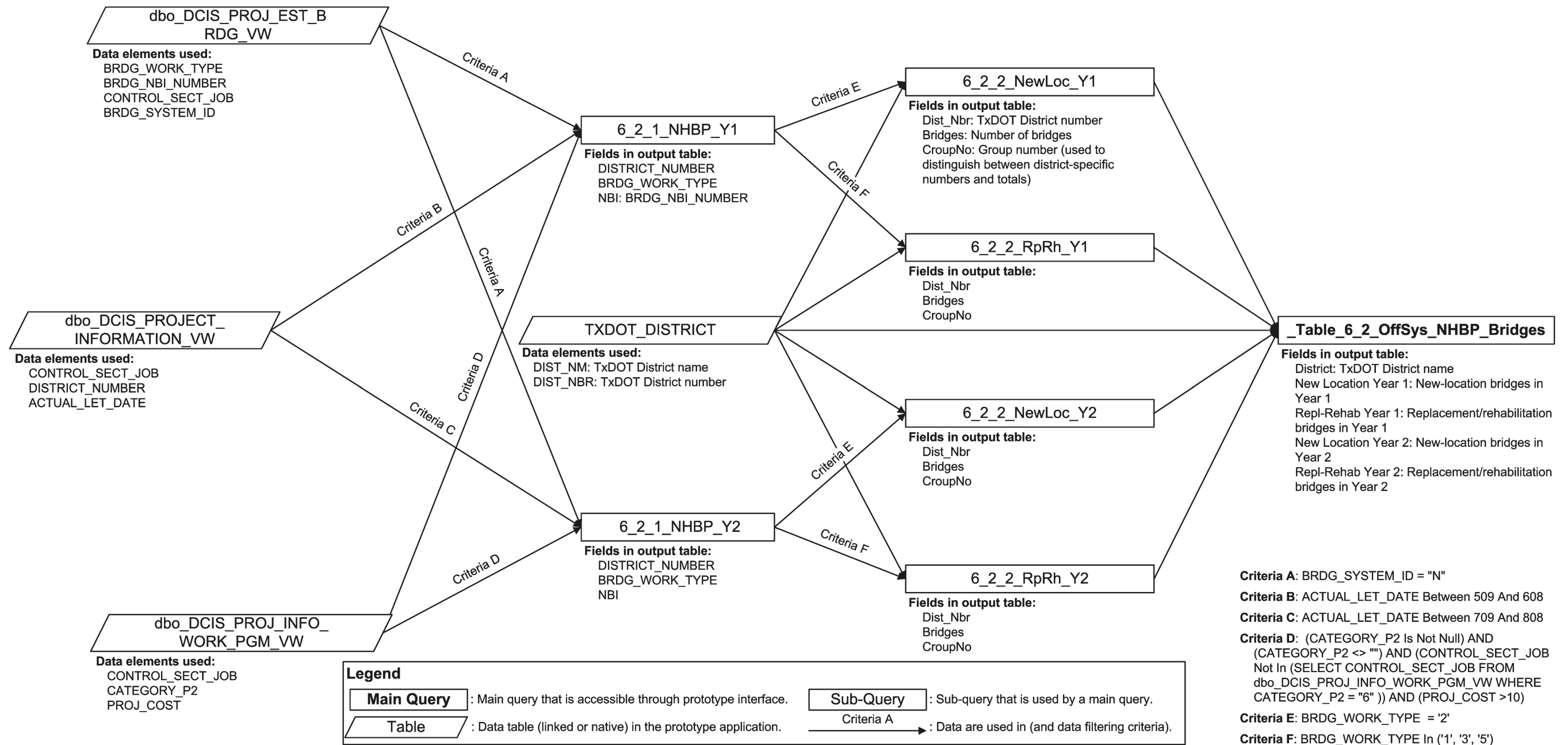


Figure 69. Structure of the _Table_6_2_OffSys_NHBP_Bridges Query.

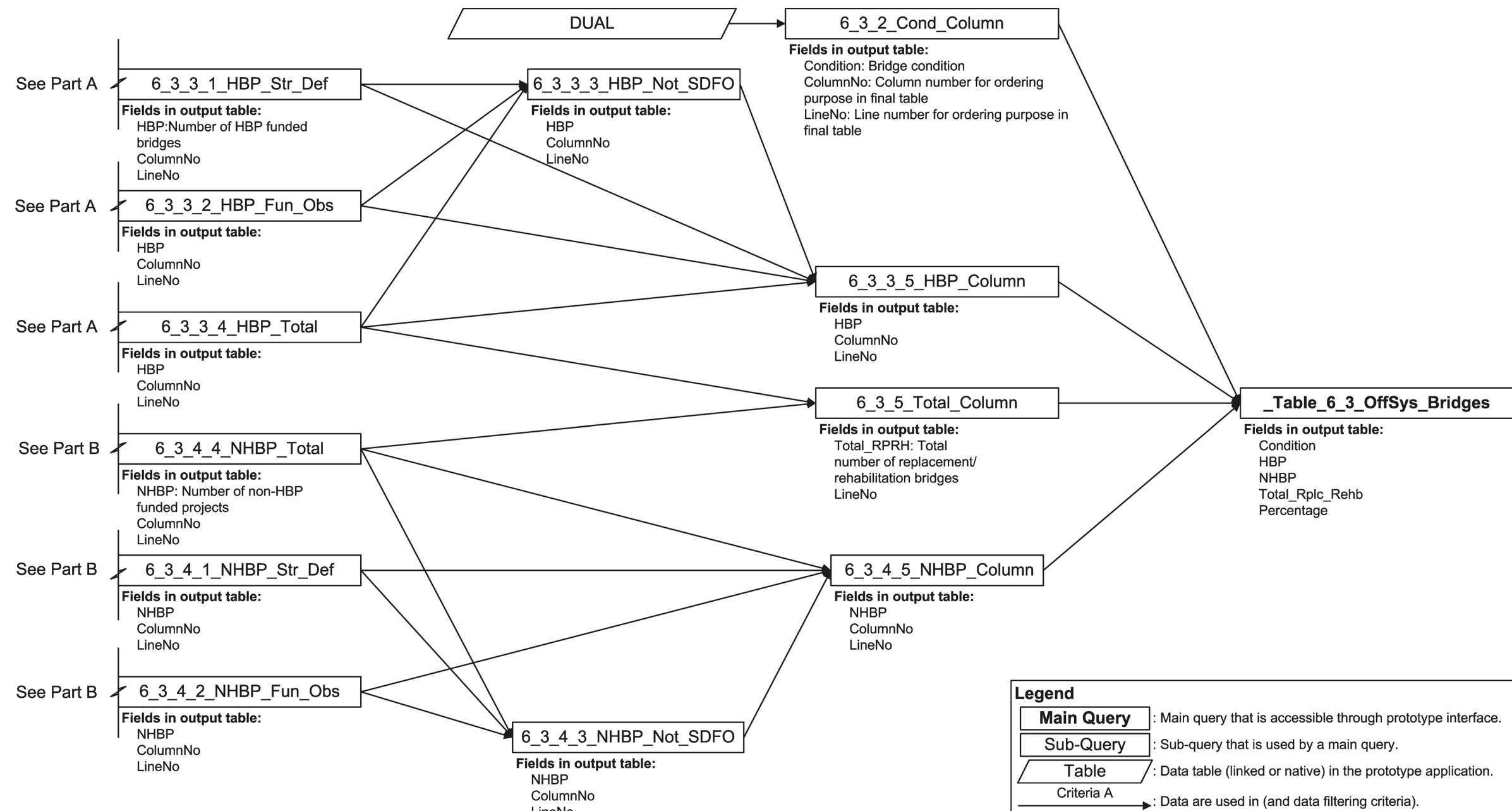


Figure 70. Structure of the _Table_6_3_OffSys_Bridges Query.

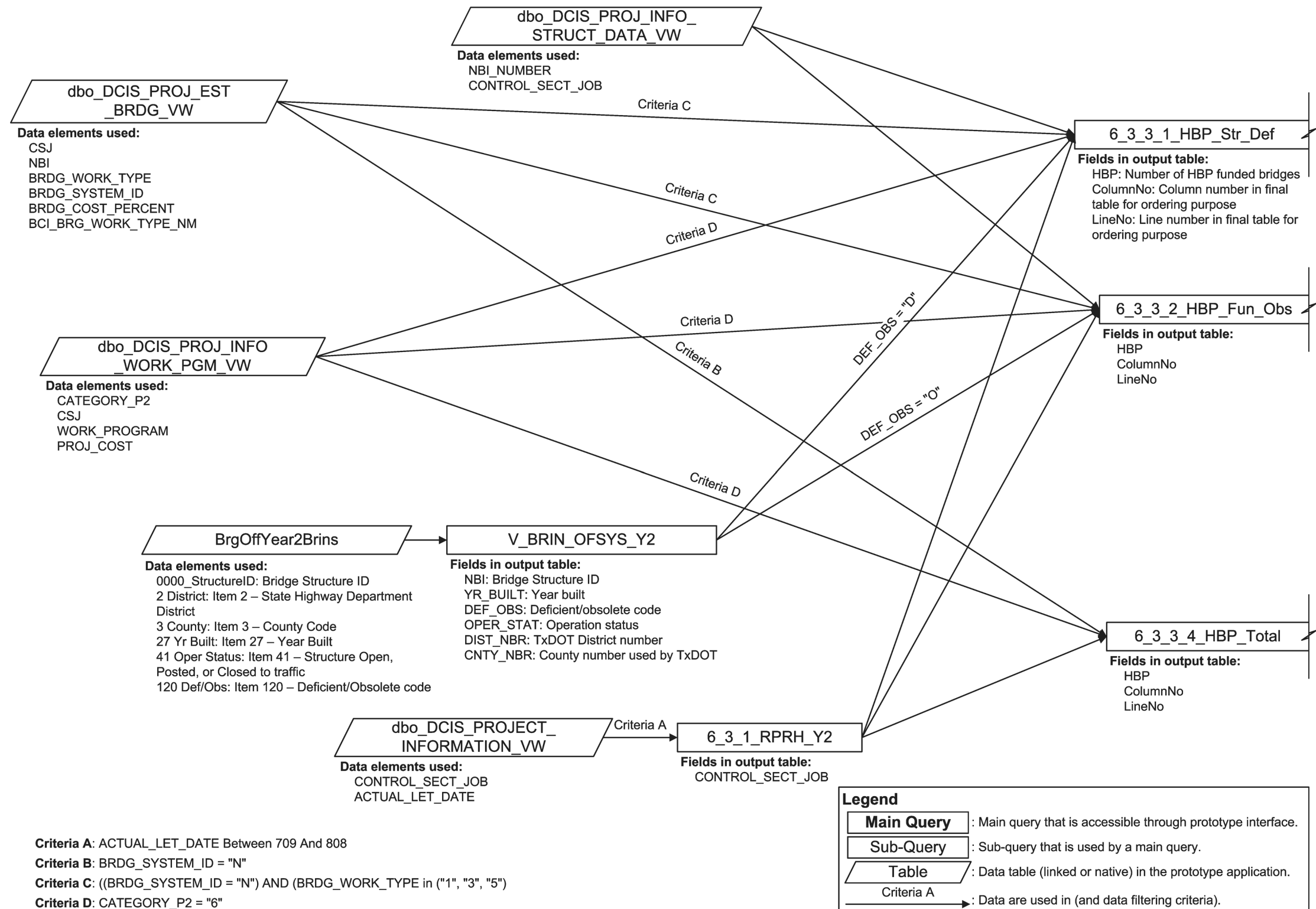


Figure 70. Structure of the Table 6_3 OffSys Bridges Query (Continued: Part A).

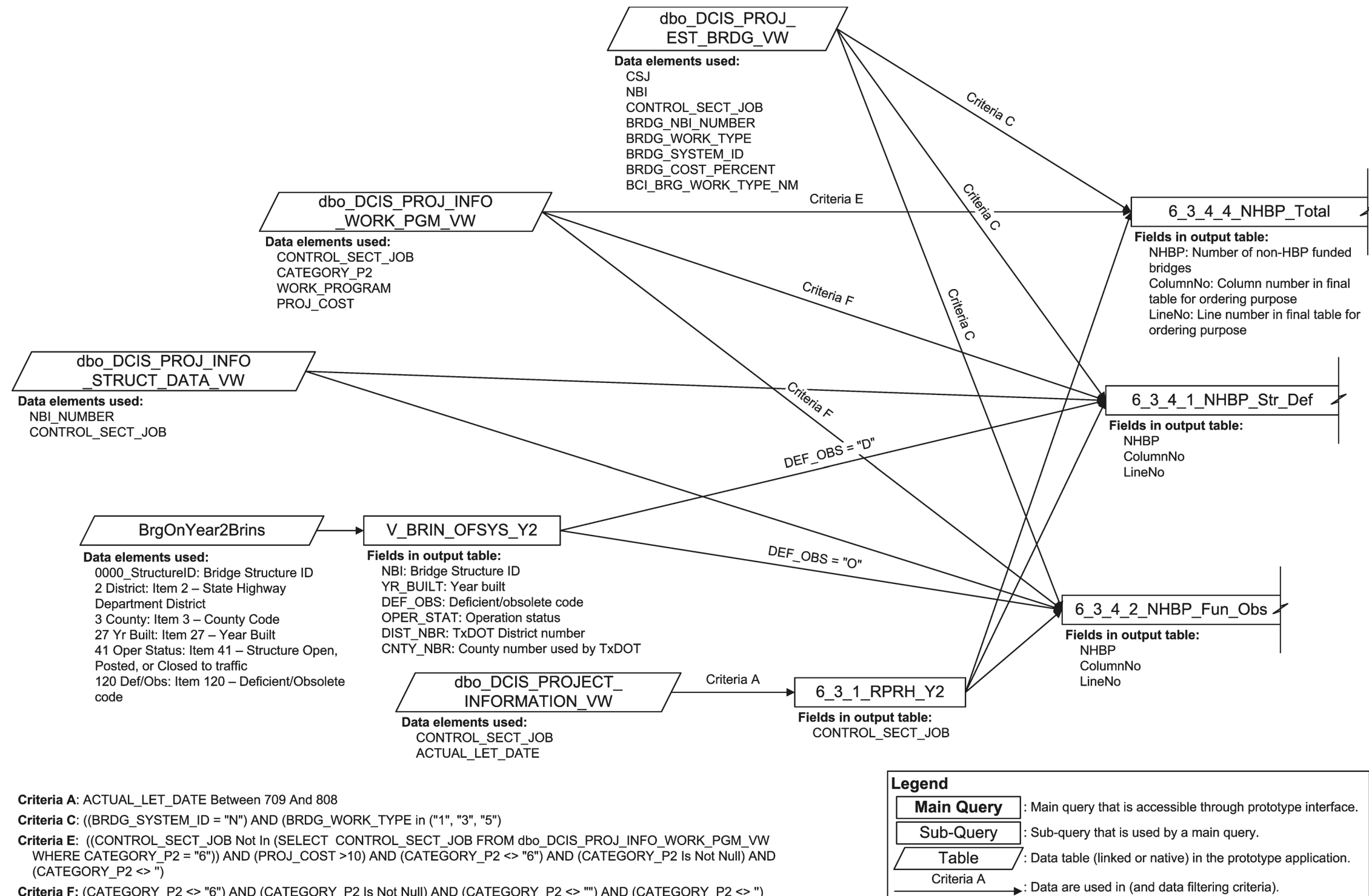


Figure 70. Structure of the _Table_6_3_OffSys_Bridges Query (Continued: Part B).

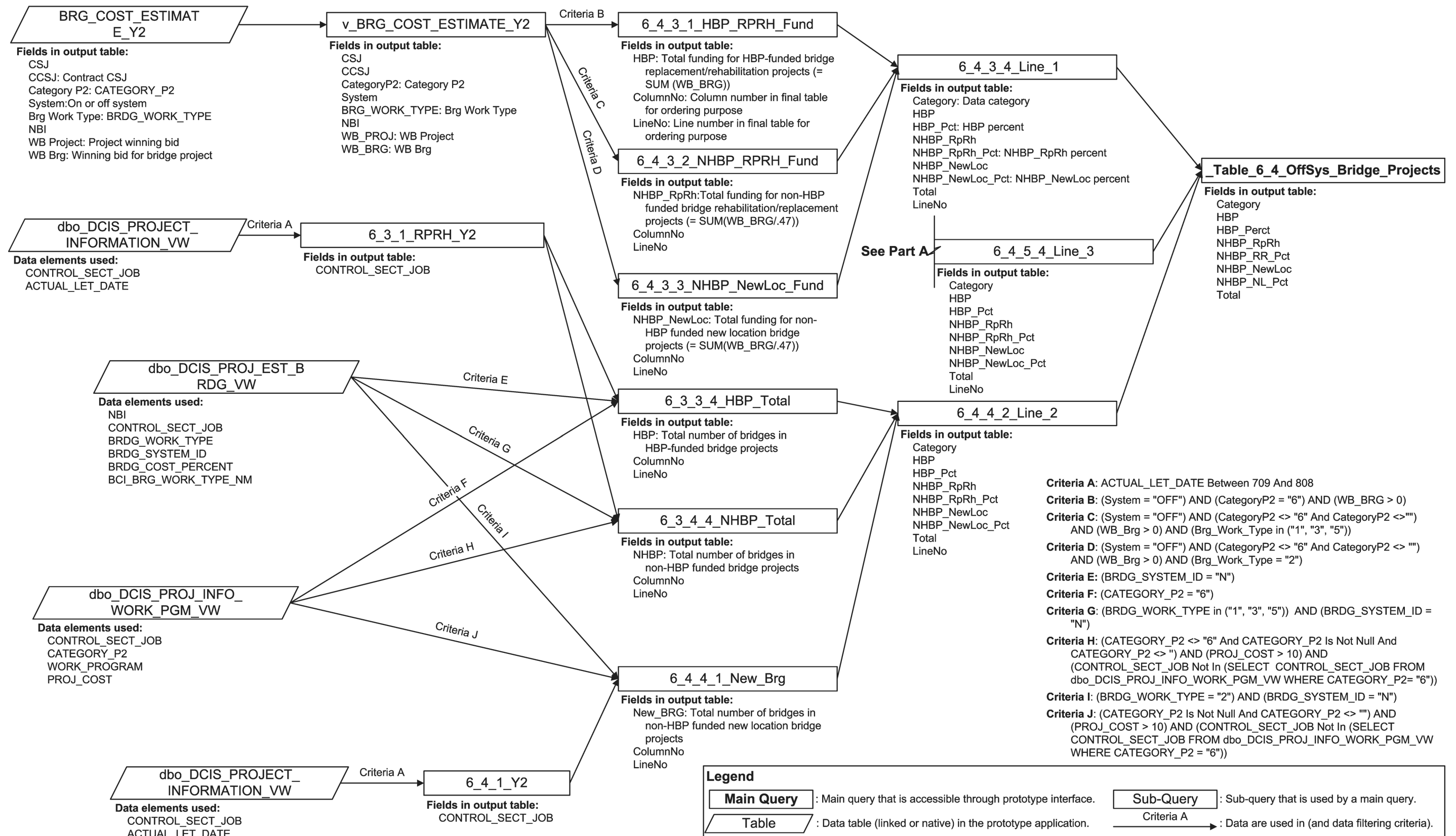
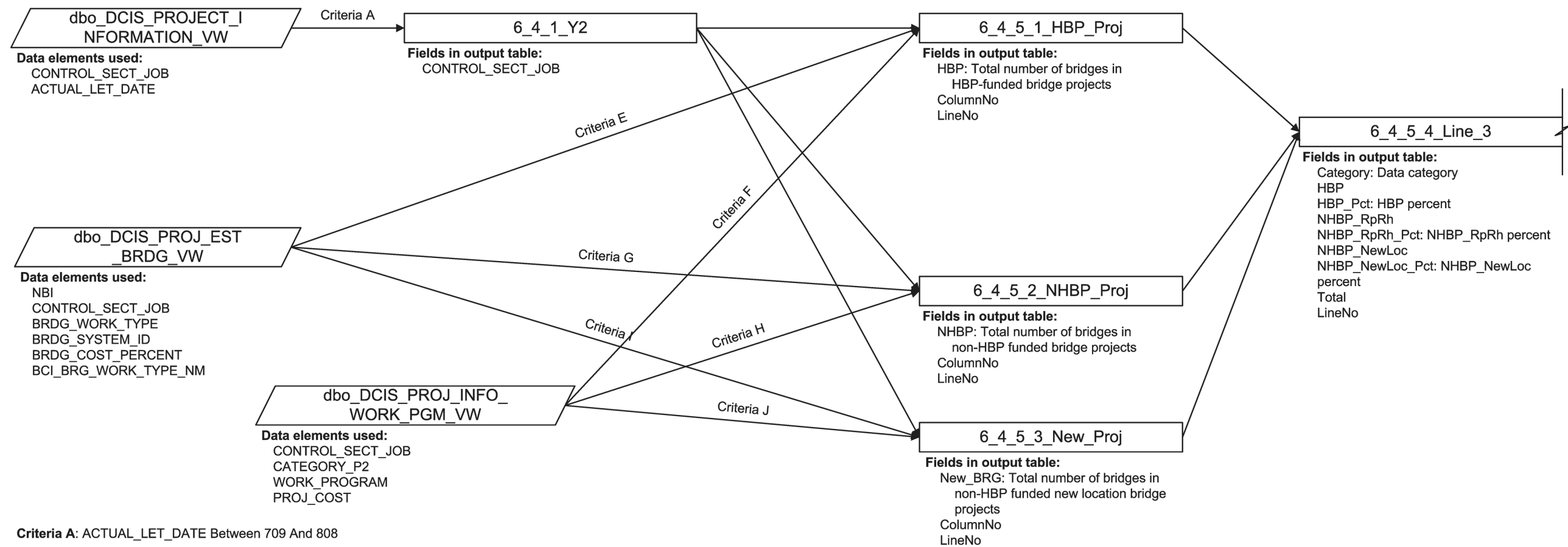


Figure 71. Structure of the _Table_6_4_OffSys_Bridge_Projects Query.



Criteria A: ACTUAL_LET_DATE Between 709 And 808

Criteria E: (BRDG_SYSTEM_ID = "N")

Criteria F: (CATEGORY_P2 = "6")

Criteria G: (BRDG_WORK_TYPE in ("1", "3", "5") AND (BRDG_SYSTEM_ID = "N"))

Criteria H: (CATEGORY_P2 <> "6" And CATEGORY_P2 Is Not Null And CATEGORY_P2 <> ") AND (PROJ_COST > 10) AND (CONTROL_SECT_JOB Not In (SELECT CONTROL_SECT_JOB FROM dbo_DCIS_PROJ_INFO_WORK_PGM_VW WHERE CATEGORY_P2= "6"))

Criteria I: (BRDG_WORK_TYPE = "2") AND (BRDG_SYSTEM_ID = "N")

Criteria J: (CATEGORY_P2 Is Not Null And CATEGORY_P2 <> "") AND (PROJ_COST > 10) AND (CONTROL_SECT_JOB Not In (SELECT CONTROL_SECT_JOB FROM dbo_DCIS_PROJ_INFO_WORK_PGM_VW WHERE CATEGORY_P2 = "6"))

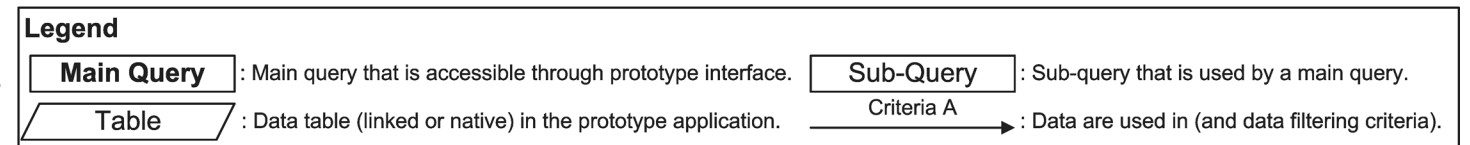


Figure 71. Structure of the _Table_6_4_OffSys_Bridge_Projects Query (Continued: Part A).

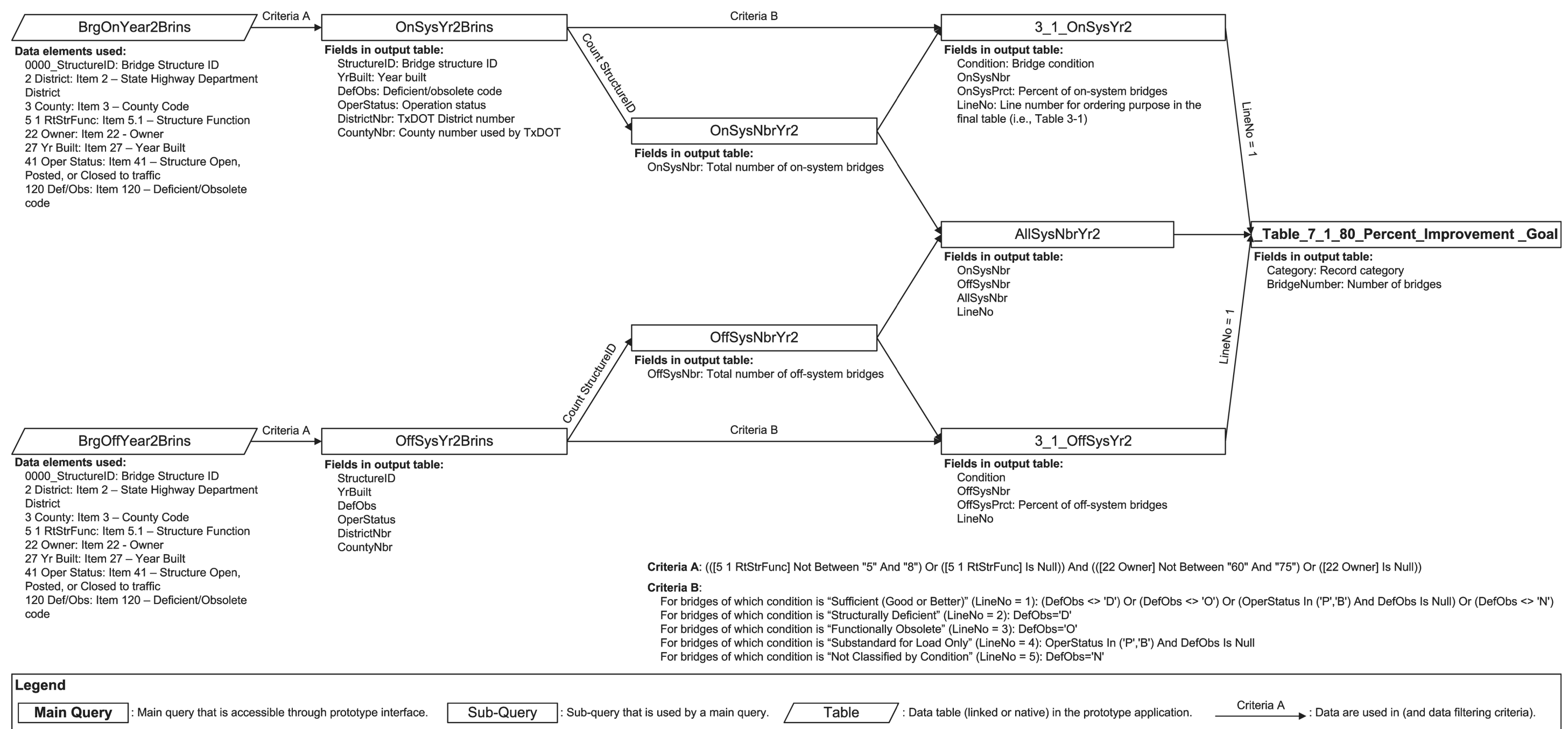


Figure 72. Structure of the _Table_7_1_80_Percent_Improvement_Goal Query.

APPENDIX B. PROTOTYPE BRIDGE COST ESTIMATE DATABASE QUERIES

The bridge cost estimate prototype database application extracts data for the production of bridge cost estimate reports. The bridge cost estimate application also produces quality control reports to check for errors in processing and in the data sources. Output of this prototype includes the following tables (i.e., reports):

- Project Estimate,
- Bridge Bid Items,
- Total Bridge Cost Estimate (i.e., “Worktable”),
- Unmatched CSJs,
- Total Bridge Cost Percentages not 100%, and
- Total Project Cost Percentages not 100%.

Chapter 4 describes the requirements for and development of the prototype database application to extract bridge cost estimate data. Chapter 5 provides installation and users guides for the prototype. This appendix provides descriptions of the steps needed to produce the tables along with their underlying queries. This appendix also includes a diagram for each of the tables and associated queries showing its structure and data elements extracted.

PROJECT ESTIMATE REPORT

The primary tab that allows the user to select which report type to view is the Bridge Reports tab. A user first selects the let date type on the Bridge Reports tab and then clicks on the Create New Table button (Figure 40). After clicking this button, the application runs the VB `btCreateTable_Click()` subroutine that creates a table containing project estimate data for the date range specified. This subroutine builds and runs the following SQL query:

```
SELECT      *
INTO        PROJECT_ESTIMATE_[date_range]
FROM        V_DCIS_PROJECT_ESTIMATE
WHERE       V_DCIS_PROJECT_ESTIMATE.ACTUAL_LET_DATE
            Between oLetDate.iFromMthYear and oLetDate.iToMthYear;
```

The results of this query are placed into the `PROJECT_ESTIMATE_[date_range]` table, which is used as a source table for other queries in this application. In the SQL query above, `V_DCIS_PROJECT_ESTIMATE` is a query that joins the `dbo_DCIS_PROJECT_ESTIMATE_VW` and `dbo_DCIS_PROJECT_INFORMATION_VW` tables, filters for null letting dates and null bid items and extracts data. Also, in the SQL query above, `oLetDate` is an object that contains the letting date range specified by the user from the Bridge Reports tab. Figure 73 illustrates the data structure of the `V_DCIS_PROJECT_ESTIMATE` query and the data structure to produce the project estimate report.

ALL RECORDS REPORT

The All Records report selects all records from the PROJECT_ESTIMATE_[date_range] table where the actual let date is equal to the date range specified. After the All Records report type is selected in the Bridge Reports tab (Figure 41), a user clicks on the Create Report button. The application builds, runs, and stores a filtered query (Figure 74), whose name is the concatenation of V_PROJECT_ESTIMATE and the letting date (e.g., V_PROJECT_ESTIMATE_2008). This filtered SQL query uses the PROJECT_ESTIMATE_[date_range] table. The resulting report is presented to the user (Figure 42) and is saved, along with the SQL query, in the database.

The V_PROJECT_ESTIMATE_2008 SQL statement for the 2008 fiscal year is as follows:

```
SELECT      *
FROM        PROJECT_ESTIMATE_2008
WHERE       (((PROJECT_ESTIMATE_2008.ACTUAL_LET_DATE) Between 709 And 808))
ORDER BY    PROJECT_ESTIMATE_2008.CONTROL_SECT_JOB,
            PROJECT_ESTIMATE_2008.LINE_NUMBER,
            PROJECT_ESTIMATE_2008.ACTUAL_LET_DATE;
```

BRIDGE BID ITEMS REPORT

The Bridge Bid Items report selects records from the PROJECT_ESTIMATE_[date_range] table that have bridge-related bid items and places these records into a bridge bid items table. After the Bridge Bid Items report type is selected in the Bridge Reports tab (Figure 41), a user clicks on the Create Report button. The application runs the VB CreateBrgItemTable() function, which runs the VB CreateBridgeItem() function to create a bridge bid item table and runs the VB CreateQuery() function to create a query to display the bridge bid items table.

In DCIS, estimate data such as bid items are associated with card type code numbers which include:

- 02 – Project work category,
- 03 – Comment line,
- 04 – Bid item or special account,
- 05 – Unique description or special account description,
- 06 – Fund source,
- 07 – Bid item that has reference numbers or spec provision numbers,
- 09 – End of bid items,
- 10 – Bid item with a special provision number,
- 11 – Spec list for temporary erosion item or for addendum to special provision, and
- 12 – Bridge cost estimate.

In general, bridge work items start with a card type of 12. The application handles two cases to associate work items with individual bridges depending on the card types that follow the card type of 12:

- **Case 1.** A series of card type records of 04 follow a card type record of 12 until a card type record different from 04 is found. This is the traditional definition for bridge work items and constitutes the simplest and most common case. For fiscal year 2009, 5,125 records corresponded to this category.
- **Case 2.** A card type record of 12 is first followed by one or more cards type records of 02, 03, or 06 (that normally provide comment information) before a card type record of 04 is found. The series ends when there is a card type record different from 04. This case is less common (e.g., 762 records were found in fiscal year 2009) but is considerably more complex from a data extraction perspective.

The VB CreateBridgeItem() function, in the CreateBrgItemTable() function, selects all records from the PROJECT_ESTIMATE_[date_range] table and then sequentially examines the card type of each record using the criteria of Cases 1 and 2. After suitable records are found, the application creates a table whose name is the concatenation of BRG_ITEMS and the letting date (e.g., BRG_ITEMS_2008).

After the BRG_ITEMS_[date_range] table has been created, the CreateQuery() function in the application creates a modified version of the V_BRG_ITEMS_TEMPLATE query. The application replaces all the dates in the V_BRG_ITEMS_TEMPLATE query with user-defined dates and creates a query whose name is the concatenation of V_BRG_ITEMS and the letting date (e.g., V_BRG_ITEMS_2008). The results of the query are presented to the user. Figure 75 illustrates the data structure of the V_BRG_ITEMS_[date_range] query and the data structure to produce the bridge bid item report.

The V_BRG_ITEMS_2008 SQL statement for the 2008 fiscal year is as follows:

```

SELECT      PE.ACTUAL_LET_DATE, PE.CONTROL_SECT_JOB, PE.LINE_NUMBER,
            PE.CARD_TYPE, PE.BIDITEM_NO, BD.BIDITEM_DSCR, PE.BIDITEM_FLAG,
            PE.ENG_QUANTITY, PE.ENG_ESTIMATE_PRICE, PE.ENG_EST_AMT, PE.UNIT_PRICE,
            PE.WIN_BID_AMT, PE.UNIT_WORK, PE.OLD_NBI_NUMBER, PE.NEW_NBI_NUMBER,
            PE.COMMENT, PE.BRIDGE_LENGTH_EXISTING, PE.BRIDGE_LENGTH_PROPOSED,
            PE.BRIDGE_WIDTH_EXISTING, PE.BRIDGE_WIDTH_PROPOSED,
            PE.BRIDGE_REMOVAL_BREAKBACK, PE.BRIDGE_WORK_TYPE,
            PE.OLD_BRIDGE_TYPE, PE.NEW_BRIDGE_TYPE, PE.ROADWAY_CLEAR_WIDTH,
            PE.BRIDGE_NAME, PE.BRIDGE_SYSTEM_ID, PE.DISTRICT_NUMBER,
            PE.COUNTY_NUMBER, PE.CONTRACT_CSJ, PE.ISN
FROM        PROJECT_ESTIMATE_2008 AS PE LEFT JOIN BIDITEM_DSCR AS BD ON
            (PE.BIDITEM_NO = BD.BIDITEM_NO) AND (PE.SPEC_BOOK_YR =
            BD.SPEC_BOOK_YR)
WHERE       (((PE.ISN) In (SELECT ISN FROM BRG_ITEMS_2008)))
ORDER BY    PE.CONTROL_SECT_JOB, PE.LINE_NUMBER;
```

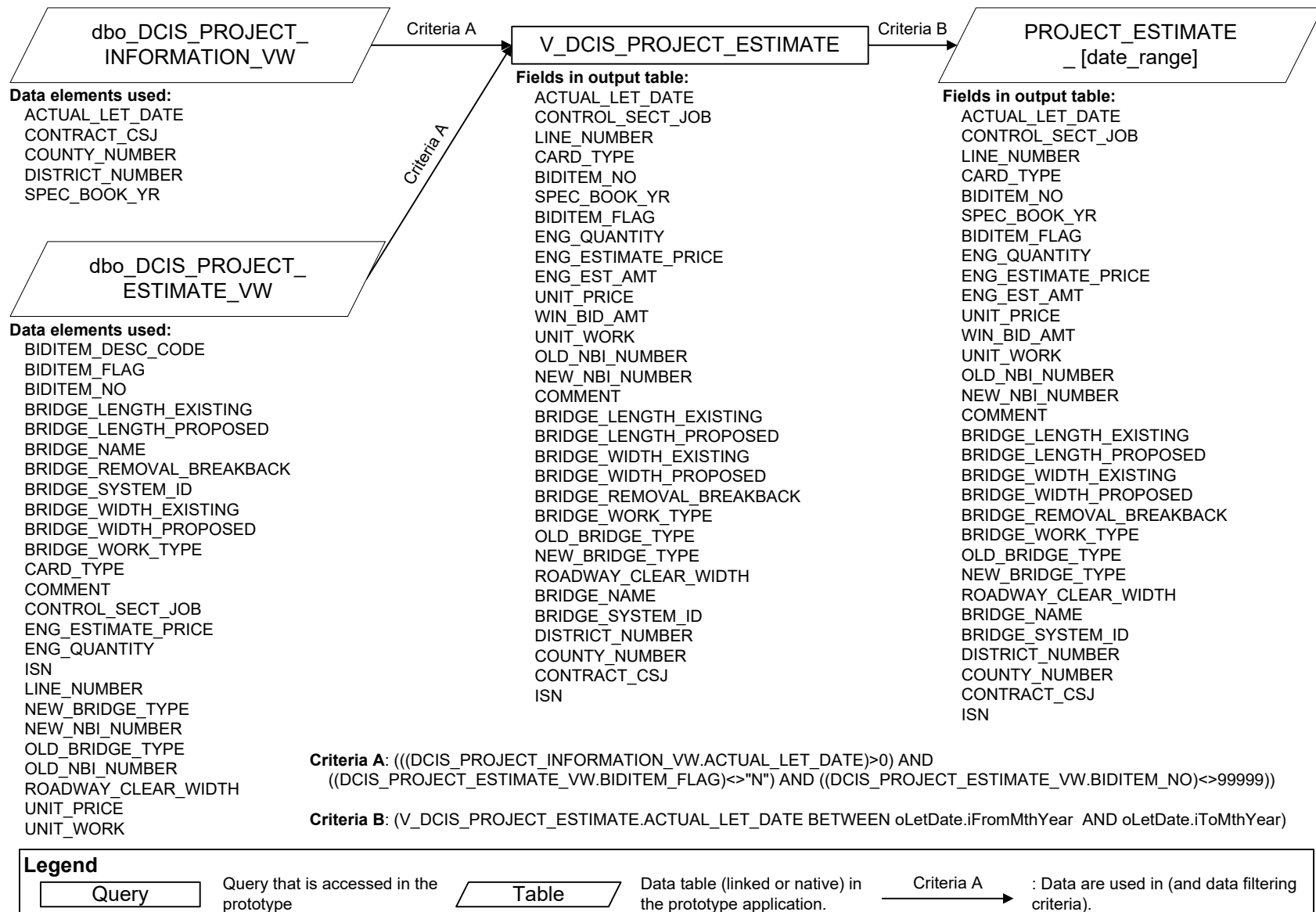


Figure 73. Data Structure of the V_DCIS_PROJECT_ESTIMATE Query.

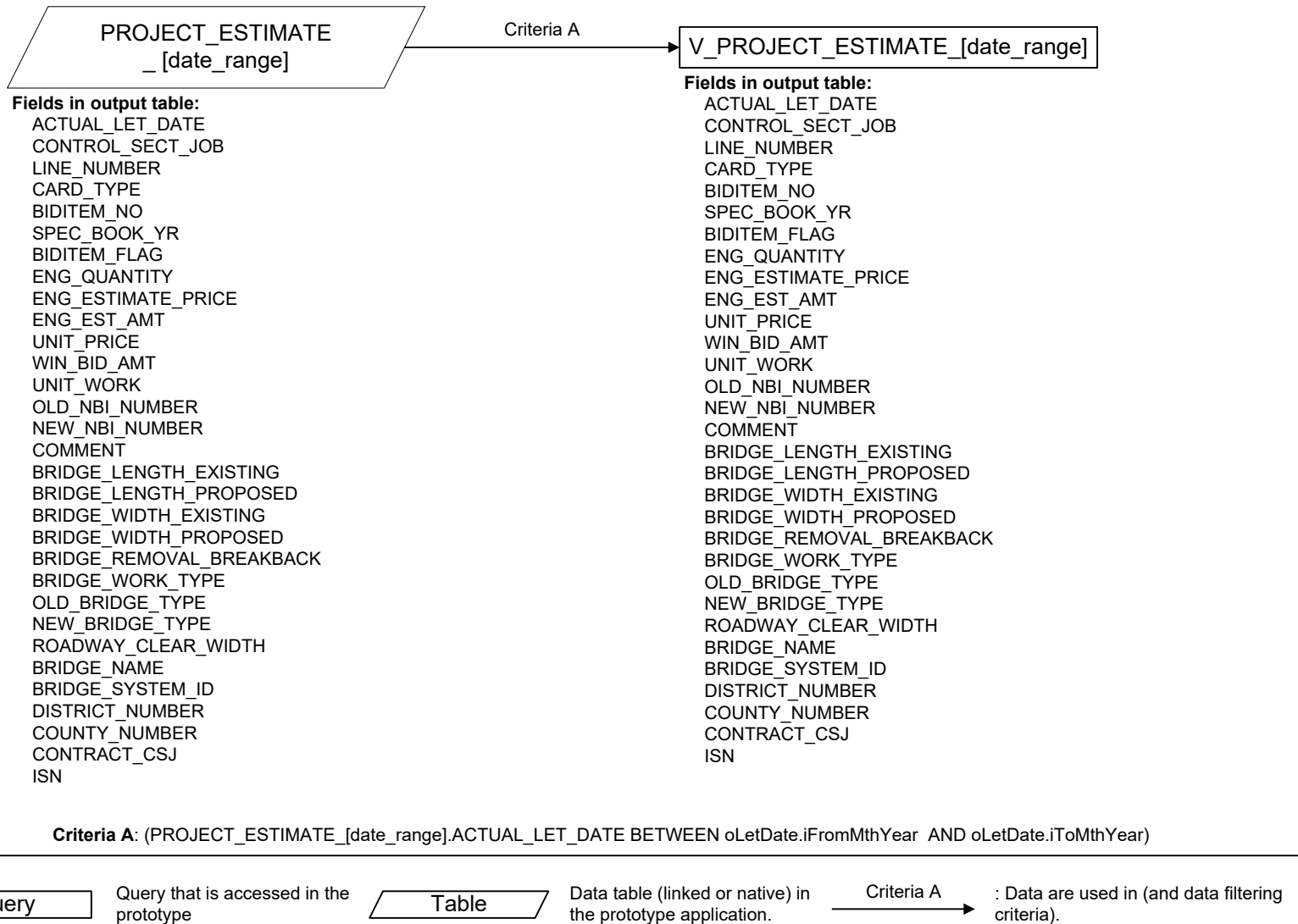


Figure 74. Data Structure of the V_PROJECT_ESTIMATE_[date_range] Query.

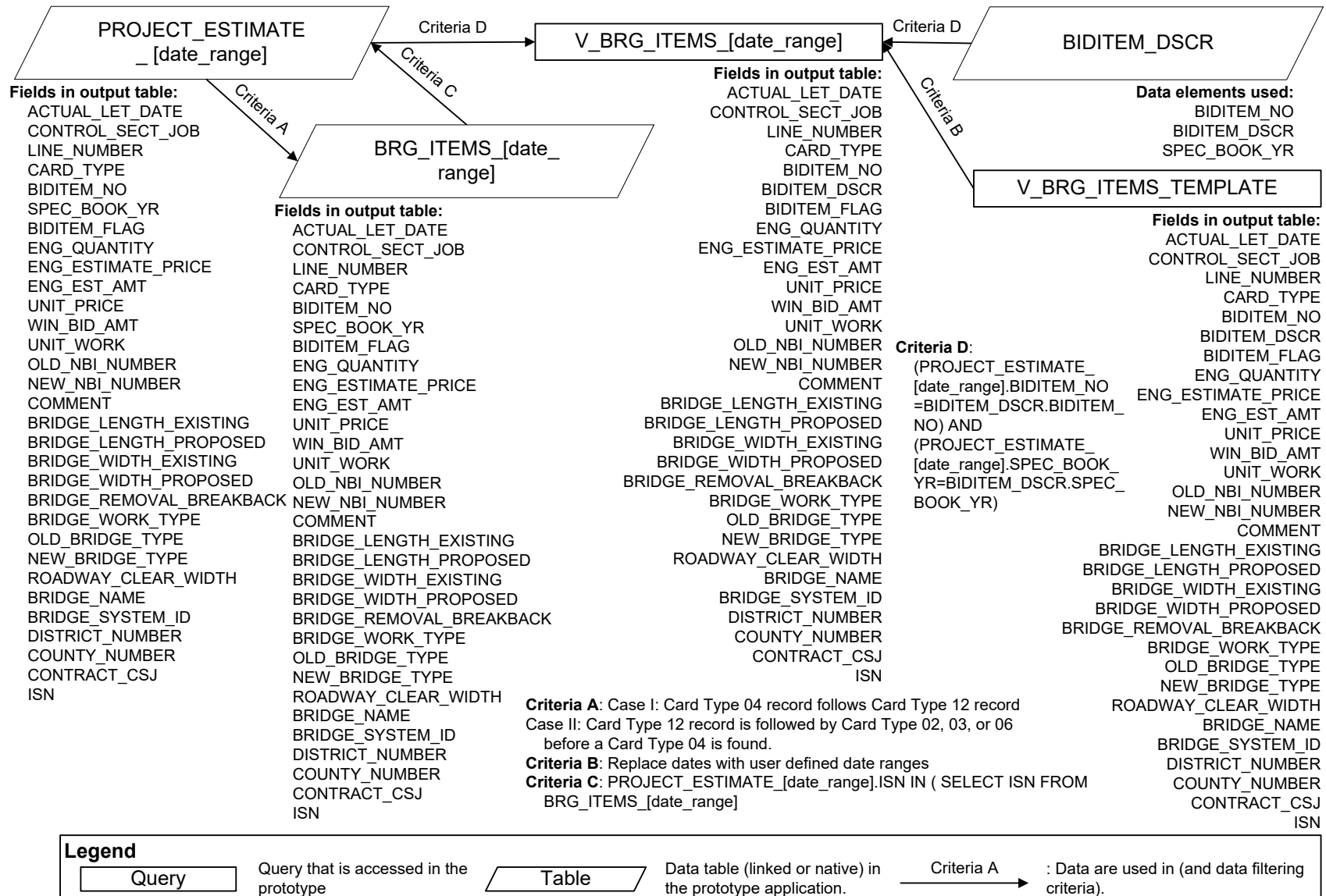


Figure 75. Data Structure for the V_BRG_ITEMS_[date_range] Query.

TOTAL BRIDGE COST ESTIMATE

The Bridge Cost Estimates report creates the following two tables:

- **Total Bridge Cost Estimate:** This table (i.e., BRG_COST_EST_[date_range]) contains total costs for individual bridges by adding the costs of all work items associated with individual bridges. This table has one record for each bridge included in a project.
- **Disaggregated Bridge Cost Estimate Table (i.e., “Worktable”):** This table (i.e., BRG_COST_REPORT_[date_range]) contains bridge cost data disaggregated by bridge cost percentages. This table may contain more than one record per bridge depending on the allocation of bridge cost percentages. This table uses the Total Bridge Cost Estimate table as an input to the process.

After the Bridge Cost Estimate report type is selected in the Bridge Reports tab (Figure 45), a user clicks on the Create Report button. The application runs the VB ShowBrgCostEstm() function, which performs the following steps:

- creates an empty BRG_COST_EST_[date_range] table,
- runs the V_BRG_ITEMS_[date_range] query,
- calculates engineering estimate and winning bid amounts,
- populates the BRG_COST_EST_[date_range] table with the query results and the bid amounts,
- creates the V_BRG_COST_EST_[date_range] query from the V_BRG_COST_EST_TEMPLATE query,
- creates the V_BRG_COST_PRESENT_[date_range] query from the V_BRG_COST_PRESENT_TEMPLATE query, which uses the V_BRG_COST_EST_TEMPLATE query as its source,
- creates a query to select the checked attributes on the Report Options tab using the V_BRG_COST_PRESENT_[date_range] query and populates the BRG_COST_REPORT_[date_range] table with the results, and
- displays the BRG_COST_REPORT_[data_range] table.

Figure 76 illustrates the data structure of the V_BRG_ITEMS_[date_range] query and the data structures to produce the BRG_COST_EST_[data_range] table. Figure 77 shows the data structure of the V_BRG_COST_PRESENT_[date_range] query and the data structures to produce the BRG_COST_REPORT_[date_range] table (i.e., Worktable).

The source of the V_BRG_COST_PRESENT_TEMPLATE query relies on the V_BRG_COST_EST_TEMPLATE query. Figure 78 shows the data structure of the V_BRG_COST_EST_TEMPLATE query, which retrieves data from multiple tables and queries. The SQL statements for both templates are provided below.

The V_BRG_COST_EST_PRESENT_2008 SQL statement, which is similar to the V_BRG_COST_PRESENT_TEMPLATE SQL statement, for the 2008 fiscal year is as follows:

```

SELECT      V.ACTL_LET_DT AS [Let Date], V.CCSJ, V.CSJ, V.DIST_NBR AS [Dist No], V.CNTY_NBR
AS [County No], V.SYSTEM AS System, V.CATEGORY_P2 AS [Category P2],
V.BRG_WRK_TYPE AS [Brg Work Type], V.PROJ_CLS AS [Proj Class], V.PROJ_NBR AS
[Proj No], V.NBI, V.BRG_TYPE AS [Brg Type], V.BRG_TYPE_PCT AS [Brg Type Pct],
V.DECK_AREA AS [Deck Area], V.BRG LENG AS Length, V.BRG_WIDTH AS Width,
V.ADJ_UNIT_PRICE AS [Adj Unit Price], V.EE_PROJ AS [EE Project], V.EE_PROJ_MOBIL
AS [EE Mobil], V.EE_Proj_Removal AS [EE Removal], V.EE_BRG AS [EE Brg],
V.EE_BRG_PCT AS [EE Brg Pct], V.EE_BRG_MOBIL AS [EE Brg Mobil],
V.EE_BY_BRG_TYPE AS [EE by Brg Type], V.EE_BRG_UNIT_COST AS [EE Brg Unit Cost],
V.WB_PROJ AS [WB Project], V.WB_PROJ_MOBIL AS [WB Mobil],
V.WB_PROJ_REMOVAL AS [WB Removal], V.WB_BRG AS [WB Brg], V.WB_BRG_PCT
AS [WB Brg Pct], V.WB_BRG_MOBIL AS [WB Brg Mobil], V.WB_BY_BRG_TYPE AS [WB
by Brg Type], V.WB_BRG_UNIT_COST AS [WB Brg Unit Cost], V.CSJ, V.NBI_

FROM        V_BRG_COST_EST_2008 AS V;

```

The V_BRG_COST_EST_2008 SQL statement, which is similar to the V_BRG_COST_EST_TEMPLATE SQL statement, for the 2008 fiscal year is as follows:

```

SELECT      BCE09.ACTL_LET_DT, BCE09.CCSJ, BCE09.CSJ, DPI.DISTRICT_NUMBER AS
DIST_NBR, DPI.COUNTY_NUMBER AS CNTY_NBR,
If(DPEB.BRDG_SYSTEM_ID='Y','ON','OFF') AS SYSTEM, IWP.CATEGORY_P2,
DPEB.BRDG_WORK_TYPE AS BRG_WRK_TYPE, DPI.PROJ_CLASS AS PROJ_CLS,
DPI.PROJECT_NUMBER AS PROJ_NBR, DPEB.BRDG_NBI_NUMBER AS NBI,
DPEB.BRDG_TYPE AS BRG_TYPE, DPEB.BRDG_COST_PERCENT AS BRG_TYPE_PCT,
DPEB.BRDG_DECK_AREA AS DECK_AREA, DPEB.BRDG_LENGTH AS BRG LENG,
Round(DECK_AREA/BRG LENG,2) AS BRG_WIDTH,
Round((EE_BRG*WB_PROJ/EE_PROJ/DECK_AREA),2) AS ADJ_UNIT_PRICE,
DPI.EST_CONST_COST AS EE_PROJ, NZ(MOBIL.PROJ_MOBIL,0) AS EE_PROJ_MOBIL,
REMOV.Proj_Removal AS EE_Proj_Removal, BCE09.BRG_EST_AMT AS EE_BRG,
Round((EE_BRG/EE_PROJ),4)*100 AS EE_BRG_PCT,
Round((EE_BRG/EE_PROJ*EE_PROJ_MOBIL),2) AS EE_BRG_MOBIL,
((EE_BRG*BRG_TYPE_PCT/100) AS EE_BY_BRG_TYPE,
Round((EE_BRG/DECK_AREA),2) AS EE_BRG_UNIT_COST, DPI.PROJ_BID_AMOUNT AS
WB_PROJ, NZ(MOBIL.PROJ_MOBIL,0) AS WB_PROJ_MOBIL,
BCE09.BRG_WIN_BID_AMT AS WB_BRG, Round((WB_BRG/WB_PROJ),4)*100 AS
WB_BRG_PCT, Round((WB_BRG/WB_PROJ*WB_PROJ_MOBIL),2) AS WB_BRG_MOBIL,
REMOV.Proj_Removal AS WB_PROJ_REMOVAL, (WB_BRG*BRG_TYPE_PCT/100) AS
WB_BY_BRG_TYPE, Round((WB_BRG/DECK_AREA),2) AS WB_BRG_UNIT_COST,
BCE09.CSJ AS CSJ_, NBI AS NBI_

FROM        (((BRG_COST_EST_2008 AS BCE09 LEFT JOIN dbo_DCIS_PROJ_EST_BRDG_VW AS
DPEB ON (BCE09.ISN = DPEB.ISN) AND (BCE09.CSJ = DPEB.CONTROL_SECT_JOB))
LEFT JOIN dbo_DCIS_PROJECT_INFORMATION_vw AS DPI ON
DPEB.CONTROL_SECT_JOB = DPI.CONTROL_SECT_JOB) LEFT JOIN
dbo_DCIS_PROJ_INFO_WORK_PGM_VW AS IWP ON BCE09.CSJ =
IWP.CONTROL_SECT_JOB) LEFT JOIN V_DCIS_PROJ_MOBILIZATION2 AS MOBIL ON
BCE09.CCSJ = MOBIL.CONTRACT_CSJ) LEFT JOIN V_DCIS_PROJ_REMOVAL AS REMV
ON BCE09.CCSJ = REMV.CONTRACT_CSJ;

```

In the V_BRG_COST_EST_2008 SQL query, the winning bid bridge percentage is the winning bid bridge amount divided by the winning bid project amount. Additionally, in this query the winning bid bridge unit cost is the bridge winning bid amount divided by the bridge deck area,

and the bridge estimate unit cost is the bridge estimate amount divided by the bridge deck area. These calculations are expressed in this query as follows:

- $WB_BRG_PCT = Round((WB_BRG / WB_PROJ), 4) * 100$
- $WB_BRG_UNIT_COST = Round((WB_BRG / DECK_AREA), 2)$
- $EE_BRG_UNIT_COST = Round((EE_BRG / DECK_AREA), 2)$

REPORT OPTIONS

The Report Options tab form (Figure 46) allows users to select the specific fields to include in the BRG_COST_REPORT_[date_range] table, created through the Bridge Cost Estimates report type in the Bridge Reports tab. Prior to creating the Bridge Cost Estimates reports, the user selects fields of interest from the Report Options tab. The fields of interest are listed in Table 23.

When a user selects the specific fields to include in the Bridge Cost Estimates reports and then clicks on the Create Report button, the VB function CreateBrgCostPhysTable checks which fields of interest have been selected in the Report Options tab. This function builds a SQL query that includes the fields of interest to populate the BRG_COST_REPORT_[date_range] table (also called the Worktable).

Table 23. Report Options Tab Fields of Interest.

Letting Date	Project Class	Engineering Estimate Project	Winning Bid Project
CCSJ	Project Number	Engineering Estimate Mobilization	Winning Bid Mobilization
CSJ	NBI	Engineering Estimate Removal	Winning Bid Removal
District Number	Bridge Type	Engineering Estimate Bridge	Winning Bid Bridge
County Number	Bridge Type Percent	Engineering Estimate Bridge Percentage	Winning Bid Bridge Percentage
System	Deck Area	Engineering Estimate Bridge Mobilization	Winning Bid Bridge Mobilization
Category P2	Length	Engineering Estimate By Bridge Type	Winning Bid By Bridge Type
Bridge Work Type	Width	Engineering Estimate Bridge Unit Cost	Winning Bid Bridge Unit Cost
	Adjusted Unit Price		

UNMATCHED CSJs REPORT

The Unmatched CSJs report contains CSJs found in the DCIS-PROJECT-INFORMATION file that are not found in the Worktable. After the Unmatched CSJ report type is selected in the Bridge Reports tab (Figure 48), a user clicks on the Create Report button. The application then

calls a VB function (i.e., FindUnmatchedCSJ) and includes the letting date range. This function builds and then runs a SQL query that finds unmatched CSJs for a given letting data range. The resulting report is presented to the user (Figure 49) and is saved in the database. Figure 79 illustrates the data structure to produce the Unmatched CSJs report.

The SQL statement built by the FindUnmatchedCSJ function for FY 2008 is as follows:

```
SELECT      *
FROM        V_DCIS_PROJ_INFO_STRUCT_DATA
WHERE       (((V_DCIS_PROJ_INFO_STRUCT_DATA.ACTUAL_LET_DATE) Between 709 And 808)
AND ((V_DCIS_PROJ_INFO_STRUCT_DATA.CONTROL_SECT_JOB) Not In (SELECT CSJ
FROM BRG_COST_REPORT_2008)));
```

The SQL statement for the V_DCIS_PROJ_INFO_STRUCT_DATA query is as follows:

```
SELECT      DISTINCT PI.ACTUAL_LET_DATE, ISD.CONTROL_SECT_JOB, PI.CONTRACT_CSI
FROM        dbo_DCIS_PROJ_INFO_STRUCT_DATA_VW AS ISD INNER JOIN
            V_DCIS_PROJECT_INFORMATION AS PI ON
            ISD.CONTROL_SECT_JOB=PI.CONTROL_SECT_JOB;
```

TOTAL BRIDGE COST PERCENTAGES NOT 100% REPORT

This report contains CSJs for which the total bridge cost percentages are under or over one-hundred percent but do not add up to one-hundred percent. After the Total Bridge Cost Percentages Not 100% report type is selected in the Bridge Reports tab (Figure 50), a user clicks on the Create Report button. The application then runs the VB function called ShowTotalBrgCostNot100, which builds, runs, and stores a query called V_TOTAL_BRG_COST_PCT_[date_range] that uses the V_COST_NOT_100_PCT_BY_NBI query to find CSJ with total bridge costs that do not add up to one-hundred percent for a given letting data range. The resulting report is presented to the user (Figure 51). Figure 80 illustrates the data structure of the V_COST_NOT_100_PCT_BY_NBI query and the data structure to produce the total bridge cost percentages not 100 percent report.

The SQL statement for the V_TOTAL_BRG_COST_PCT query for FY 2008 built by the ShowTotalBrgCostNot100 function is as follows:

```
SELECT      *
FROM        V_COST_NOT_100_PCT_BY_NBI
WHERE       (((V_COST_NOT_100_PCT_BY_NBI.ACTUAL_LET_DATE) Between 709 And 808));
```

The SQL statement for the V_COST_NOT_100_PCT_BY_NBI query is as follows:

```
SELECT      PEB.CONTROL_SECT_JOB AS CSJ, PEB.BRDG_NBI_NUMBER AS NBI,
            Sum(PEB.BRDG_COST_PERCENT) AS [Total Cost (%)], PI.ACTUAL_LET_DATE
FROM        V_DCIS_PROJ_EST_BRG AS PEB INNER JOIN V_DCIS_PROJECT_INFORMATION AS PI
            ON PEB.CONTROL_SECT_JOB=PI.CONTROL_SECT_JOB
GROUP BY    PEB.CONTROL_SECT_JOB, PEB.BRDG_NBI_NUMBER, PI.ACTUAL_LET_DATE
HAVING      (((Sum(PEB.BRDG_COST_PERCENT))<>100))
ORDER BY    PEB.CONTROL_SECT_JOB, PEB.BRDG_NBI_NUMBER;
```

TOTAL PROJECT COST PERCENTAGES NOT 100% REPORT

This report contains CSJs for which the total project cost percentages do not add up to 100%. After the Total Project Cost Percentages Not 100% report type is selected in the Bridge Reports tab (Figure 52), a user clicks on the Create Report button. The application then runs the VB function called ShowTotalBrgCost, which builds, runs, and stores a query called V_TOTAL_PROJ_COST_PCT_[date_range] that uses the V_PROJ_COST_PERCENT query to find CSJs with total project cost percentages that are not 100%. The resulting report is presented to the user (Figure 53). Figure 81 illustrates the data structures of the V_PROJ_COST_PERCENT and the V_TOTAL_PROJ_COST_PCT_[date_range] queries.

The SQL statement for the V_TOTAL_PROJ_COST_PCT query for FY 2008 built by the ShowTotalPrjCost() function is as follows:

```
SELECT      PCP.CONTROL_SECT_JOB, Sum(PCP.BRDG_COST_PERCENT) AS TOTAL_PROJ_COST
FROM        V_PROJ_COST_PERCENT AS PCP
WHERE       (((PCP.ACTUAL_LET_DATE) Between 709 And 808))
GROUP BY   PCP.CONTROL_SECT_JOB
HAVING      (((Sum(PCP.BRDG_COST_PERCENT))<>100));
```

The SQL statement for the V_PROJ_COST_PERCENT query is as follows:

```
SELECT      PI.ACTUAL_LET_DATE, PEB.CONTROL_SECT_JOB, PEB.BRDG_COST_PERCENT
FROM        dbo_DCIS_PROJ_EST_BRDG_VW AS PEB INNER JOIN
            V_DCIS_PROJECT_INFORMATION AS PI ON
            PEB.CONTROL_SECT_JOB=PI.CONTROL_SECT_JOB;
```

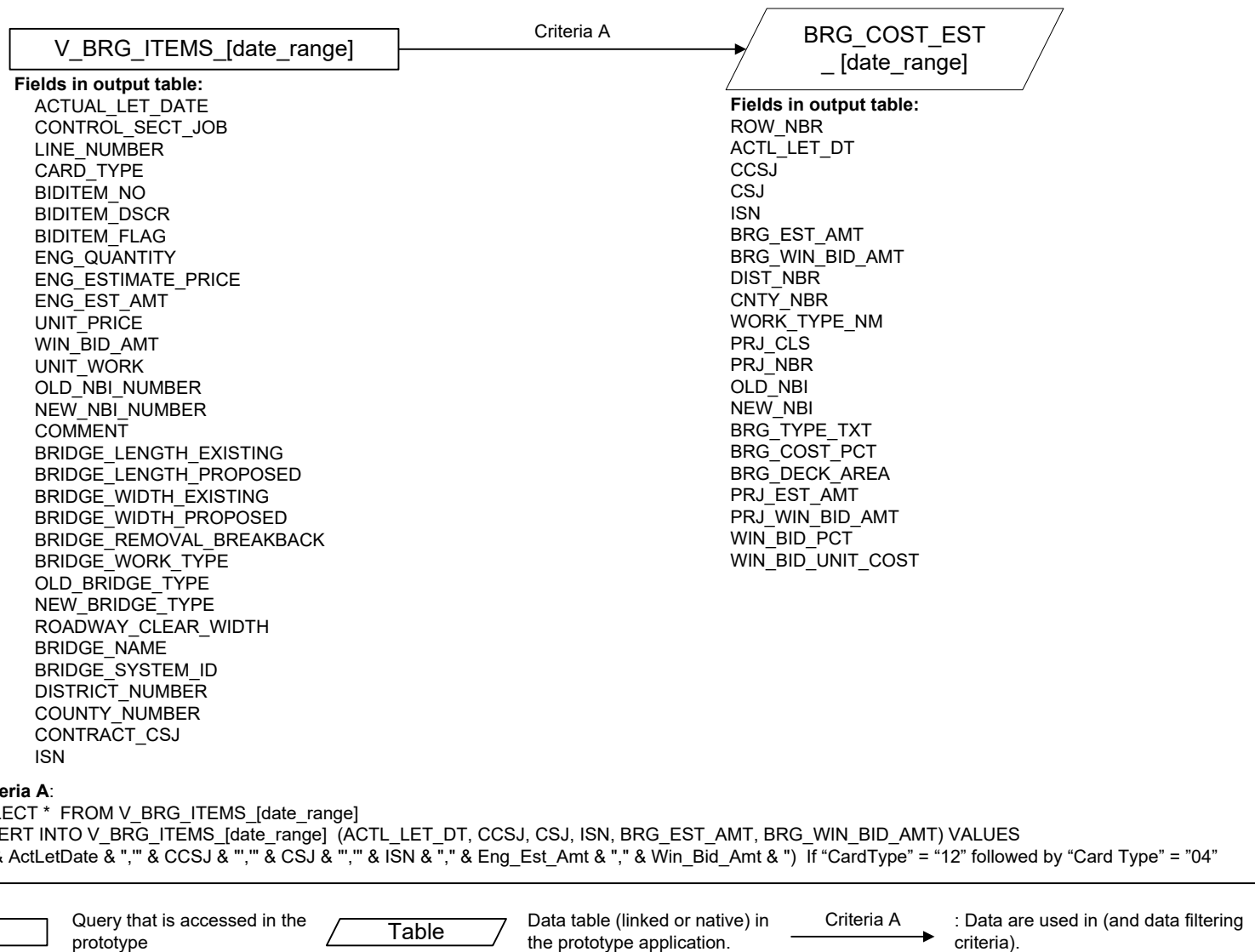


Figure 76. Data Structure for the BRG_COST_EST_[date_range] Table.

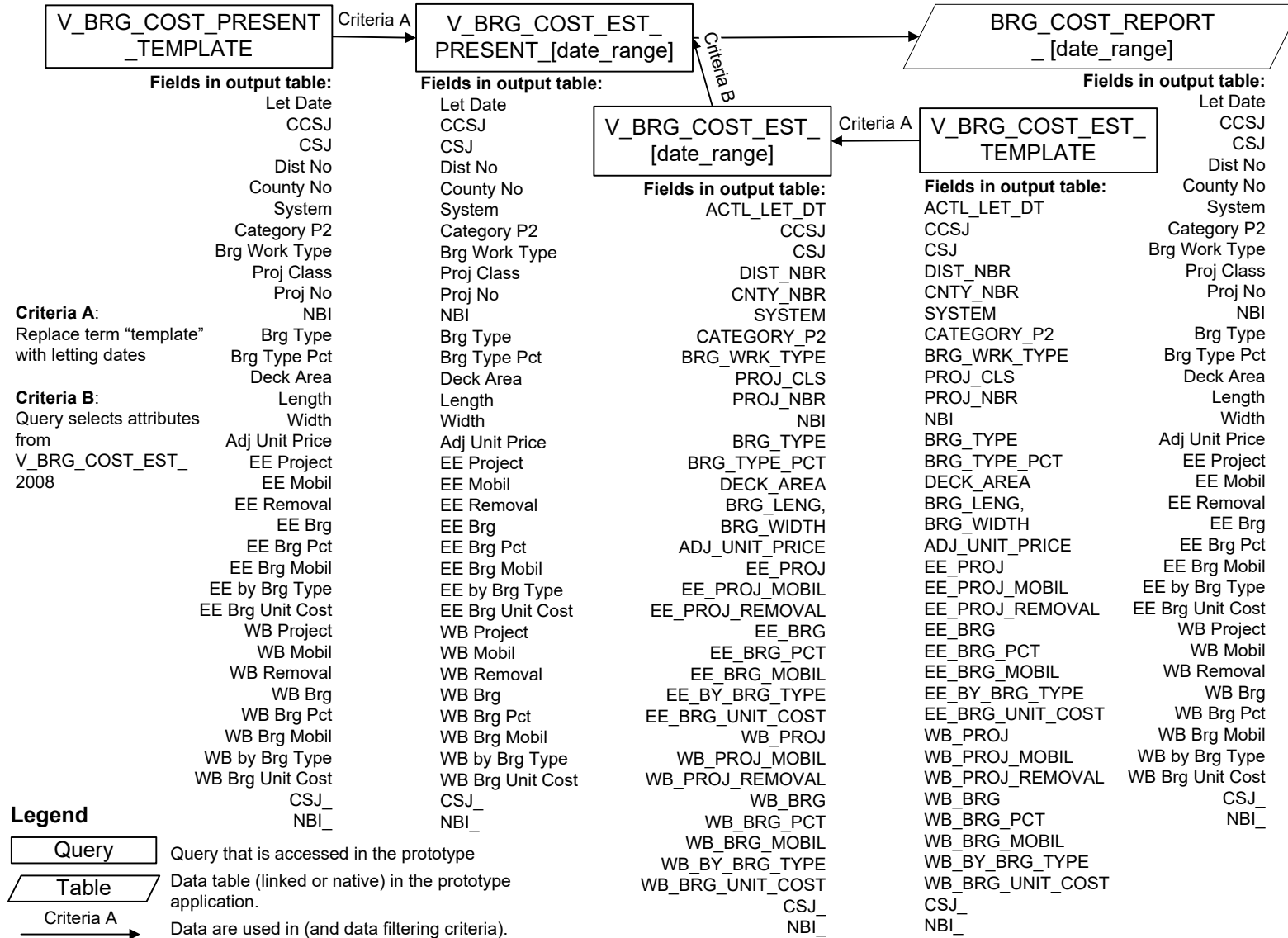


Figure 77. Data Structure of the BRG_COST_REPORT_[date_range] Table.

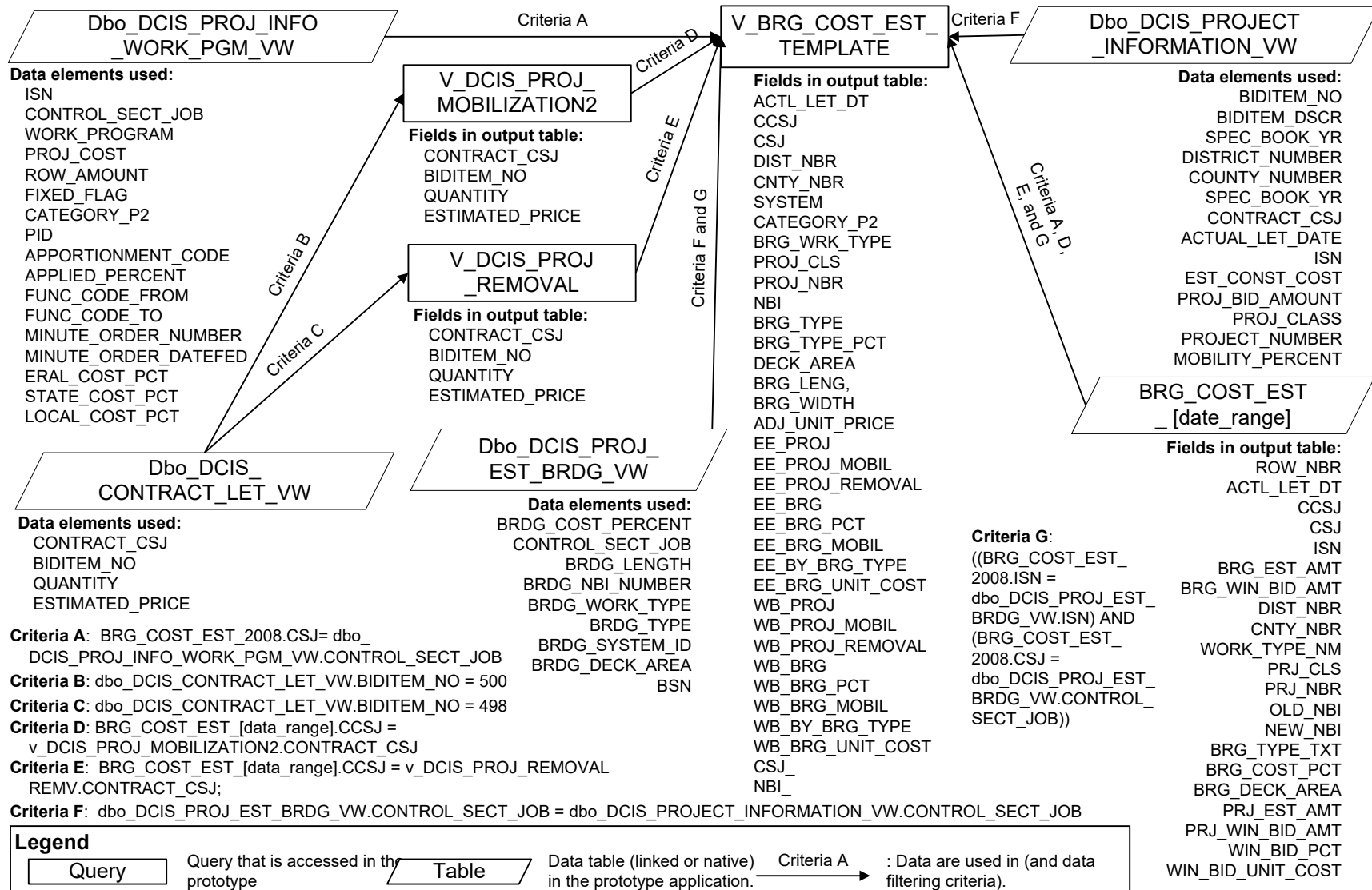


Figure 78. Data Structure of the V_BRG_COST_EST_TEMPLATE Query.

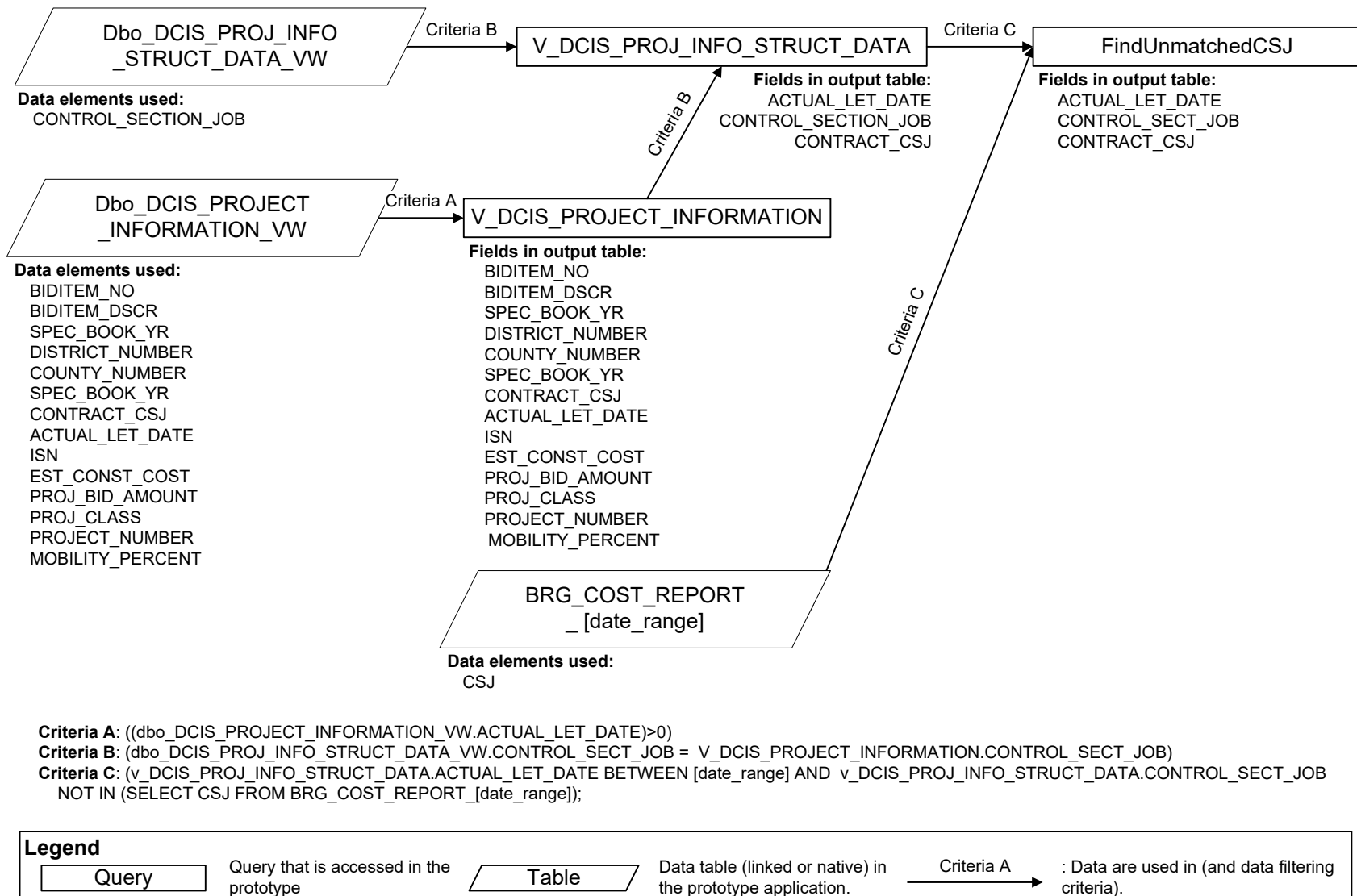


Figure 79. Data Structure of the V_UNMATCHED_CSJ Query.

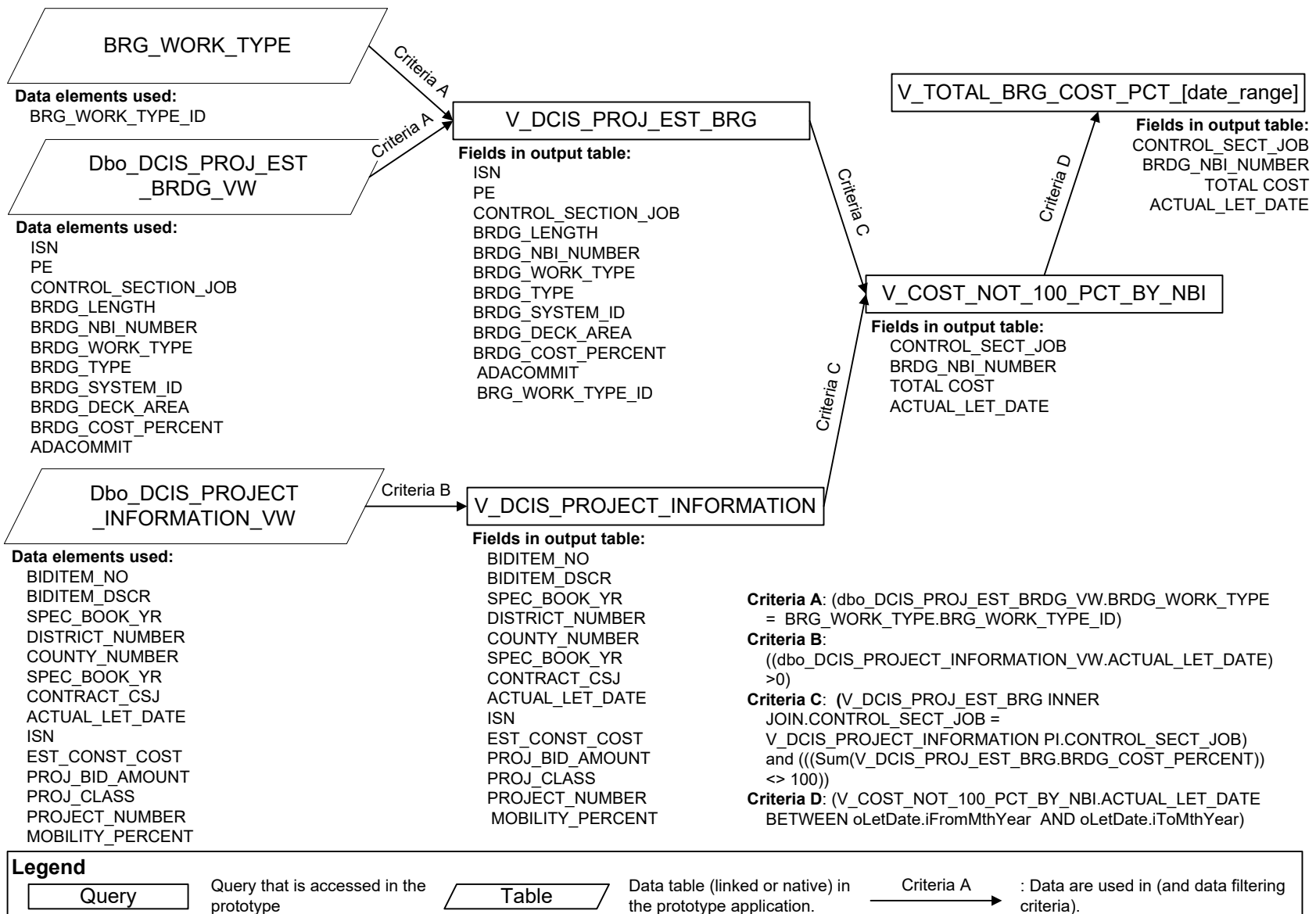


Figure 80. Data Structure of the V_COST_NOT_100_PCT_BY_NBI Query.

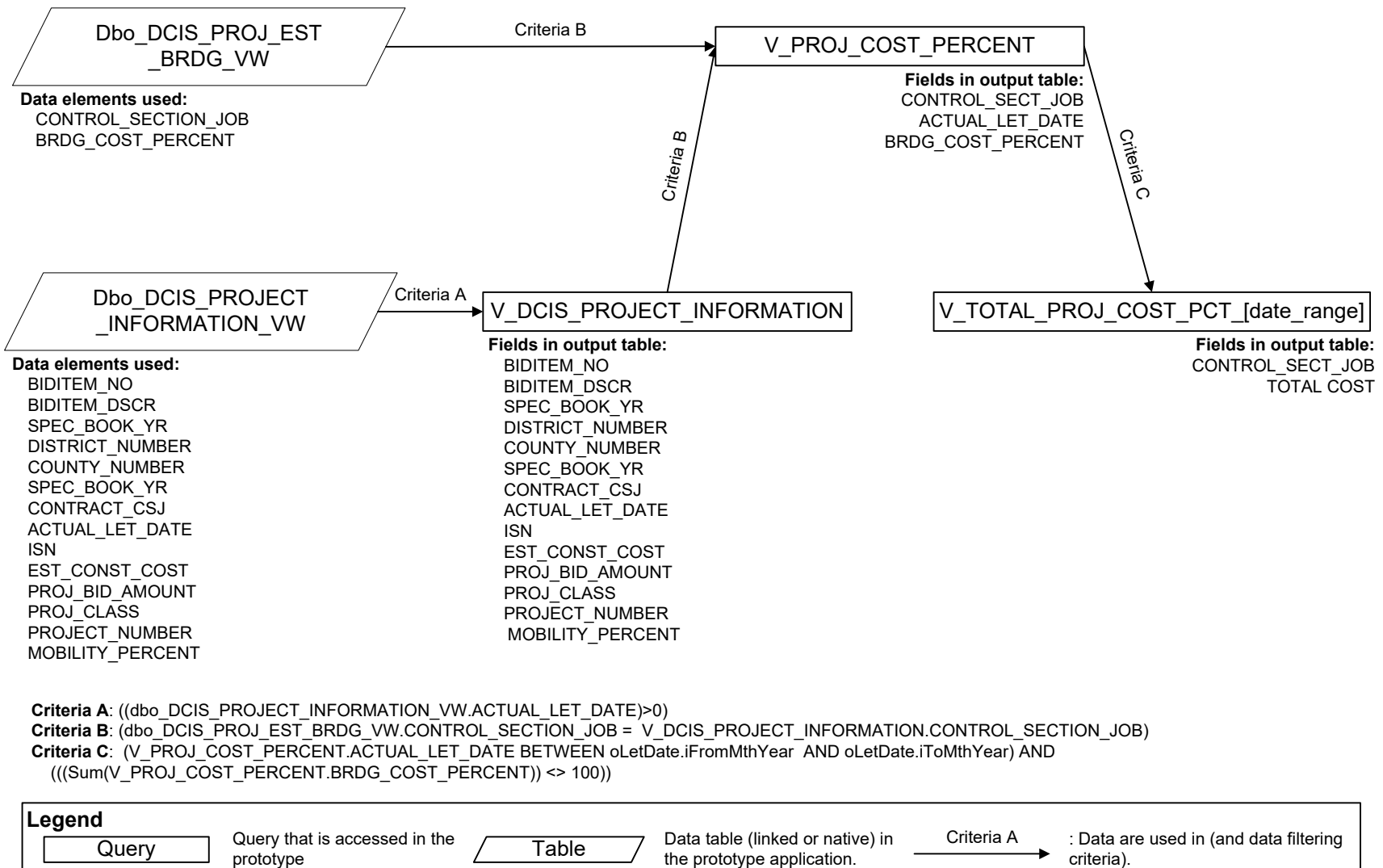


Figure 81. Data Structure of the V_TOTAL_PROJ_COST_PCT_[date_range] Query.